PREFACE

The following describes the information location, layout, and editorial conventions in the Arkansas Nuclear One – Unit 2 (ANO-2) License Renewal Application (hereinafter referred to as “this application” or “the application"). Abbreviated names and acronyms used throughout the application are defined in the table at the end of this preface. Commonly understood terms (such as U.S.) and terms used only in referenced document numbers may not be identified in this table. Regulatory documents such as NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and 10CFRPart 54 - *Requirements for Renewal of Operating Licenses for Nuclear Power Plants* (the license renewal rule) are referred to by the document number, i.e., NUREG-1801 and 10CFR54, respectively. References to the SAR are to the ANO-2 Updated Final Safety Analysis Report.

Section 1 provides administrative information required by 10CFR54.17 and 10CFR54.19.

Section 2 describes and justifies the methods used to determine the systems and structures within the scope of license renewal and the structures and components subject to aging management review. The results of the system and structure scoping are provided in Tables 2.2-1 through 2.2-4. Tables 2.2-1a, 2.2-1b and 2.2-3 list mechanical systems, electrical systems and structures, respectively, within the scope of license renewal. Tables 2.2-2 and 2.2-4 list the systems and structures, respectively, not in the scope of license renewal. Section 2 also provides descriptions of in-scope systems and structures and their intended functions with tables identifying components and commodities requiring aging management review and their intended functions. The tables provide a reference to the results of the aging management review for each component and commodity type. The descriptions of systems in Section 2 identify license renewal drawings that document the components subject to aging management review for mechanical systems. The drawings are provided in a separate submittal.

Section 3 describes the results of aging management reviews of mechanical, electrical and structural components requiring aging management review. Section 3 is divided into sections that address (1) the reactor vessel, internals, and reactor coolant system, (2) engineered safety features, (3) auxiliary systems, (4) steam and power conversion systems, (5) containment, structures, and component supports, and (6) electrical and instrumentation and controls. The tables in Section 3 provide a summary of information concerning aging effects requiring management and applicable aging management programs for component and commodity groups subject to aging management review. The information presented in the tables is based on the format and content of NUREG-1800, *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants*, U. S. Nuclear Regulatory Commission, April 2001. The tables include comparisons with the evaluations documented in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, U.S. Nuclear Regulatory Commission, April 2001.

Section 4 addresses time-limited aging analyses, as defined by 10CFR54.3. It includes identification of the component or subject and an explanation of the time dependent aspects of the calculation or analysis. Section 4 demonstrates whether (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Section 4 also confirms that no 10CFR50.12 exemption involving a time-limited aging analysis as defined in 10CFR54.3 is required during the period of extended operation. The information in Section 4 fulfills the requirements in 10CFR54.21(c).

Appendix A, Updated Final Safety Analysis Report Supplement, provides a summary description of programs and activities for managing the effects of aging for the period of extended operation. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is also included. Following issuance of the renewed license, the material contained in this appendix will be incorporated into the Safety Analysis Report (SAR). The information in Appendix A fulfills the requirements in 10CFR54.21(d).

Appendix B, Aging Management Programs, describes aging management programs and activities that will manage aging effects on components and structures within the scope of license renewal such that they will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Appendix B contains a comparison of the ANO-2 programs to the programs evaluated in NUREG-1801. The information in Section 2, Section 3, and Appendix B fulfills the requirements of 10CFR54.21(a).

Appendix C is not used.

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 in 10CFR54.22.

Appendix E is the environmental information which fulfills the requirements of 10CFR54.23 and 10CFR51.53(c).

ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	**Description**
AAC	Alternate AC
AC	alternating current
ACI	American Concrete Institute
ACW	auxiliary cooling water
AEC	Atomic Energy Commission
AISC	American Institute of Steel Construction
ANO	Arkansas Nuclear One
ANO-1	Arkansas Nuclear One - Unit 1
ANO-2	Arkansas Nuclear Two - Unit 2
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWWA	American Water Works Association
B&PV	Boiler and Pressure Vessel
BAW (B&W)	Babcock and Wilcox
BWR	boiling water reactor
CASS	cast austenitic stainless steel
CE	Combustion Engineering
CEA	control element assembly
CEDM	control element drive mechanism
CFR	Code of Federal Regulations
CLB	current licensing basis

Abbreviation/Acronym	**Description**
CMAA	Crane Manufacturers Association of America
CSB	core support barrel
CST	condensate storage tank
CvUSE	charpy upper-shelf energy
DBA	design basis accident
DC	direct current
DOR	Division of Operating Reactors
DFAS	diverse emergency feedwater actuation system
DSS	diverse scram system
EAI	Entergy Arkansas, Inc.
ECCS	emergency core cooling system
ECP	emergency cooling pond
EDG	emergency diesel generator
EFPD	effective full power days
EFPY	effective full power years
EFW	emergency feedwater
EHC	electro-hydraulic control
EOI	Entergy Operations, Inc.
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	Applicant’s Environmental Report-Operating License Renewal Stage
ESF	engineered safety features
ESFAS	engineered safety features actuation system
FAP	fuel assembly alignment plate
ft-lb	foot-pound

Abbreviation/Acronym	**Description**
FIV	flow induced vibration
FP	fire protection
GALL	NUREG-1801, *Generic Aging Lessons Learned*
GDC	General Design Criterion
GL	Generic Letter
GSI	Generic Safety Issue
HELB	high-energy line break
HPSI	high pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
IASCC	irradiation-assisted stress corrosion cracking
ICI	incore instrumentation
IGA	intergranular attack
IGSCC	inter-granular stress corrosion cracking
ILRT	integrated leakage rate test
IN	Information Notice
INEL	Idaho National Engineering Laboratory
IPA	integrated plant assessment
IR	insulation resistance
ISG	Interim Staff Guidance
ISI	inservice inspection
ksi	1000 pounds per square inch
KV or kV	kilo-volt
KW	kilo-Watt

Abbreviation/Acronym	**Description**
LBB	leak before break
LOCA	loss of coolant accident
LPSI	low pressure safety injection
LRA	license renewal application
LTOP	low temperature overpressure protection
MCL	main coolant line
MeV	mega-electron volt
MIC	microbiologically influenced corrosion
MNSA	mechanical nozzle seal assembly
MRP	Material Reliability Program
MSS	Manufacturer's Standardization Society
MWe	megawatts-electric
MWt	megawatts-thermal
N2	nitrogen supply
NaOH	sodium hydroxide
n/cm^2	neutrons per square centimeter
NDE	non-destructive examinations
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
ODSCC	outside diameter stress corrosion cracking
PASS	post-accident sampling system
pH	potential hydrogen

Abbreviation/Acronym	**Description**
ppm	parts per million
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAPM	Quality Assurance Program Manual
RCP	reactor coolant pump
RCS	reactor coolant system
RHR	residual heat removal
RMS	radiation monitoring system
RTD	resistance temperature detector
RT_{PTS}	reference temperature (pressurized thermal shock)
RV	reactor vessel
RVI	reactor vessel internals
RVID	reactor vessel integrity database
RWT	refueling water tank
SAR	Safety Analysis Report
SBO	station blackout
SCC	stress corrosion cracking
SDC	shutdown cooling
SER	Safety Evaluation Report
SFP	spent fuel pool
SG	steam generator
SS	stainless steel

Abbreviation/Acronym	Description
SSC	system, structure, and component
SW	service water
T/4	one fourth of the way through the vessel wall
TLAA	time-limited aging analysis (analyses)
TS	Technical Specifications
TSP	trisodium phosphate
USAS	USA Standard
UGS	upper guide structure
USE	upper-shelf energy
VCT	volume control tank

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1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10CFR54), this application seeks renewal for an additional 20 year term of the facility operating license for Arkansas Nuclear One – Unit 2 (ANO-2). The facility operating license (NPF-6) expires at midnight July 17, 2018. The application applies to renewal of the source, special nuclear, and by-product materials licenses that are combined in the facility operating license.

The application is organized in accordance with the U.S. Nuclear Regulatory Commission Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," April 2001, and is consistent with the guidance provided by NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 - License Renewal*.

The license renewal application is intended to provide sufficient information for the NRC to complete its technical and environmental reviews pursuant to 10 CFR Parts 54 and 51, respectively. The license renewal application is designed to allow the NRC to make the findings required by 10CFR54.29 in support of the issuance of a renewed facility operating license for ANO-2.

1.1 GENERAL INFORMATION

The following is the general information required by 10CFR54.17 and 10CFR54.19.

1.1.1 <u>Name of Applicant</u>

Entergy Operations, Inc., (operator) and Entergy Arkansas, Inc. (owner).

1.1.2 <u>Address of Applicant</u>

Entergy Operations (ANO-2)
1448 State Road 333
Russellville, AR 72802

1.1.3 <u>Description of Business of Applicant</u>

Entergy Operations is an operating subsidiary of the Entergy Corporation, which is an investor-owned utility. Entergy Operations is engaged in the production of electric power primarily for portions of the states of Arkansas, Mississippi, Louisiana, and Texas. As a major part of this electricity production, Entergy Operations operates five nuclear power plants with a combined capacity of approximately 4875 megawatts.

1.1.4 Legal Status and Organization

Entergy Operations and Entergy Arkansas are public utilities incorporated under the laws of the state of Delaware. The Entergy Operations and Entergy Arkansas principal offices are located in Jackson, Mississippi and Little Rock, Arkansas, respectively, at the following addresses:

Entergy Operations, Inc. 1340 Echelon Parkway Jackson, MS 39213	Entergy Arkansas, Inc. 425 West Capitol Avenue Little Rock, AR 72201

Entergy Operations and Entergy Arkansas are not owned, controlled, or dominated by any alien, a foreign corporation, or foreign government. Entergy Operations and Entergy Arkansas make this application on their own behalf and are not acting as an agent or representative of any other person.

The names and business addresses of the Entergy Operations and Entergy Arkansas directors and principal officers, all of whom are citizens of the United States, are as follows:

Directors of Entergy Operations, Inc

Gary Taylor EOI Chairman	Entergy Operations, Inc. 1340 Echelon Parkway Jackson, Mississippi 39213
Donald C. Hintz President	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
C. John Wilder Executive Vice President and Chief Financial Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113

Principal Officers of Entergy Operations, Inc

Gary Taylor Chief Executive Officer	Entergy Operations, Inc. 1340 Echelon Parkway Jackson, Mississippi 39213
C. John Wilder Executive Vice President and Chief Financial Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113

Principal Officers of Entergy Operations, Inc (Continued)

William R. Campbell Senior Vice President and Chief Operating Officer	Entergy Operations, Inc. 1340 Echelon Parkway Jackson, Mississippi 39213
William E. Madison Senior Vice President – Human Resources and Administration	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Jeff S. Forbes Vice President – Operations (Grand Gulf)	Grand Gulf Nuclear Power Station P.O. Box 756 Port Gibson, Mississippi 39150
Paul Hinnenkamp Vice President – Operations (River Bend)	River Bend Nuclear Power Station 5485 U.S. Highway 61 St. Francisville, Louisiana 70775
Craig G. Anderson Vice President – Operations (Arkansas Nuclear One)	Arkansas Nuclear One 1448 State Road 333 Russellville, Arkansas 72802
Joseph E. Venable Vice President – Operations (Waterford 3)	Waterford Nuclear Power Station 17265 River Road Killona, Louisiana 70066
Nathan E. Langston Senior Vice President and Chief Accounting Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Steven C. McNeal Vice President and Treasurer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
William A. Eaton Vice President - Engineering	Entergy Operations, Inc. 1340 Echelon Parkway Jackson, Mississippi 39213
Joseph L. Blount General Attorney-Generation	Entergy Operations, Inc. 1340 Echelon Parkway Jackson, Mississippi 39213

Directors of Entergy Arkansas, Inc

Hugh T. McDonald EAI Chairman	Entergy Arkansas, Inc. 425 West Capitol Avenue Little Rock, Arkansas 72201
Donald C. Hintz President	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
C. John Wilder Executive Vice President and Chief Financial Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113

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C. John Wilder Executive Vice President and Chief Financial Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
William E. Madison Senior Vice President – Human Resources and Administration	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Frank F. Gallaher President – Generation, Transmission and Energy Management	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Robert D. Sloan Senior Vice President – General Counsel	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
John Tom Kennedy Vice President – State Governmental Affairs	Entergy Arkansas, Inc. 425 West Capitol Avenue Little Rock, Arkansas 72201

Principal Officers of Entergy Arkansas, Inc (Continued)

Joseph T. Henderson Senior Vice President and General Tax Counsel	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Nathan E. Langston Senior Vice President and Chief Accounting Officer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113
Steven C. McNeal Vice President and Treasurer	Entergy Corporation 639 Loyola Avenue New Orleans, Louisiana 70113

1.1.5 Class and Period of License Sought

Entergy Operations requests renewal of the Class 103 facility operating license for ANO-2 (facility operating license NPF-6) for a period of 20 years. License renewal would extend the facility operating license from midnight July 17, 2018 to midnight July 17, 2038.

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

1.1.6 Alteration Schedule

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

1.1.7 Regulatory Agencies with Jurisdiction

The Arkansas Public Service Commission has jurisdiction over the rates and services provided by Entergy Operations, Inc., and Entergy Arkansas, Inc., at ANO-2. The address of this state commission is as follows:

Arkansas Public Service Commission
PO Box 400
Little Rock, AR 72203-0400

1.1.8 Local News Publications

The trade and news publications which circulate in the area surrounding ANO-2, and which are considered appropriate to give reasonable notice of the renewal application to those municipalities, private utilities, public bodies, and cooperatives that might have a potential interest in the facility, include the following.

The Courier
PO Box 887
Russellville, AR 72811

Post Dispatch
PO Box 270
Dardanelle, AR 72834

Dover Times
PO Box 547
Dover, AR 72837

1.1.9 Conforming Changes to Standard Indemnity Agreement

10CFR54.19(b) requires that license renewal applications include, “conforming changes to the standard indemnity agreement, 10 CFR 140.92 Appendix B, to account for the expiration term of the proposed renewal license.” The current indemnity agreement for ANO-2 states in Article VII that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment to the agreement, which is the last to expire. Item 3 of the Attachment to the indemnity agreement as revised by Amendment No. 6, lists ANO-2 operating license number NPF-6. Entergy Operations requests that conforming changes be made to Article VII of the indemnity agreement, and Item 3 of the Attachment to that agreement, specifying the extension of agreement until the expiration date of the renewed ANO-2 facility operating license sought in this application. In addition, should the license number be changed upon issuance of the renewal license, Entergy Operations requests that conforming changes be made to Item 3 of the Attachment, and other sections of the indemnity agreement as appropriate.

1.1.10 Restricted Data Agreement

This application does not contain restricted data or national security information, and Entergy Operations does not expect that any activity under the renewed license for ANO-2 will involve such information. However, if such information were to become involved, Entergy Operations agrees that it will appropriately safeguard such information and not permit any individual to have access to, or any facility to possess, such information until the individual or facility has been approved under the provisions of Parts 10 CFR 25 or 10 CFR 95, respectively.

1.2 PLANT DESCRIPTION

The ANO site is located in southwestern Pope County, Arkansas, on a peninsula formed by Lake Dardanelle. ANO-2 employs a Combustion Engineering pressurized water reactor nuclear steam supply system licensed to generate 3026 MWt, or approximately 1023 MWe. The current facility operating license for ANO-2 expires at midnight July 17, 2018. The ANO-2 unit includes a containment building, an auxiliary building, an intake structure, and a common turbine building shared with ANO-1.

Entergy Operations operates an independent spent fuel storage installation in accordance with 10 CFR Part 72 at ANO. The independent spent fuel storage installation is an independent facility subject to separate licensing provisions under 10 CFR Part 72. The independent spent fuel storage installation is not within scope of 10 CFR Part 54 or this application.

2.0 Scoping And Screening Methodology For Identifying Structures And Components Subject To Aging Management Review And Implementation Results

This chapter describes the process for identification of structures and components subject to aging management review in the ANO-2 integrated plant assessment (IPA). For those systems, structures, and components (SSCs) within the scope of license renewal, 10CFR54.21(a)(1) requires a license renewal applicant to identify and list structures and components subject to aging management review. Furthermore, 10CFR54.21(a)(2) requires that methods used to identify these structures and components be described and justified. Technical information in this chapter serves to satisfy these requirements.

The scoping and screening method is described in Section 2.1 This method is implemented in accordance with ANO's Quality Assurance Program. The results of the assessment to identify the systems and structures within the scope of license renewal (plant level scoping) are in Section 2.2. The results of the identification of the components and structural components subject to aging management review (screening) are in Section 2.3 for mechanical systems, Section 2.4 for structures, and Section 2.5 for electrical and instrumentation and controls systems.

The following table gives the expanded definitions of intended functions used in this application for structures and components. The tables in the application may refer to either the intended function name or to the abbreviation.

Table 2.0-1
Intended Functions: Abbreviations and Definitions

Intended Function	Abbreviation	Definition
Conducts electricity	CE	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals
CEA support	CEAS	Provide support, orientation, guidance and protection of the control element assemblies
Core support	CS	Provide support and orientation of the reactor core
EQ barrier	EQB	Provides an environmental qualification (EQ) barrier
Filtration	FLT	Provides filtration
Fire barrier	FB	Provides a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
Flood barrier	FLB	Provides a protective barrier for internal/external flood events
Flow control	FC	Provides flow control
Flow distribution	FD	Provides for flow distribution. For the RCS, provide a passageway for the distribution of the reactor coolant flow to the reactor core.
Heat sink	HS	Provides a heat sink during station blackout or design basis accidents
Heat transfer	HT	Provides for heat transfer
HELB shielding	HELB	Provide shielding against high energy line breaks (HELB)
Incore support	INS	Provide a passageway for support, guidance, and protection for the incore instrumentation
Insulation	IN	To insulate and support an electrical conductor
Missile barrier	MB	Provides a missile (internal or external) barrier
Pressure boundary	PB	Provides a pressure boundary
Support for Criterion (a)(2) equipment	SNS	Provides structural or functional support to nonsafety-related equipment whose failure could impact safety-related equipment (10CFR54.4(a)(2))

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

Intended Function	Abbreviation	Definition
Shelter or protection	SP	Provide shelter or protection to safety-related equipment (including radiation shielding and pipe whip restraint)
Support for Criterion (a)(3) equipment	SRE	Provides structural or functional support to equipment required to meet the Commission's regulations for the five regulated events in 10CFR54.4(a)(3)
Support for Criterion (a)(1) equipment	SSR	Provides structural or functional support for safety-related equipment
Vortex elimination	VXE	Prevent formation of vortices under flow conditions

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 Scoping Methodology

The license renewal rule (10CFR54) defines the scope of license renewal. 10CFR54.4(a) requires systems, structures, and components (SSCs) to be included in the license renewal process if they are—

(1) Safety-related systems, structures, and components which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions—
   (i) The integrity of the reactor coolant pressure boundary;
   (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
   (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in § 50.34(a)(1), § 50.67(b)(2), or § 100.11 of this chapter, as applicable.

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

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

NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule* (Reference 2.1-5)**,** provides industry guidance for determining what SSCs are in the scope of license renewal. The process used to determine the systems and structures in the scope of license renewal for ANO-2 followed the recommendations of NEI 95-10.

Consistent with NEI 95-10, the scoping process used for ANO-2 license renewal began with a list of plant systems and structures, determined the functions they perform, and then determined which functions met any of the three criteria of 10CFR54.4. Functions that meet any of the criteria are intended functions for license renewal, and the systems and structures that perform these functions are included in the scope of license renewal. The systems list was developed from the ANO-2 component database and the structures list from a review of civil/structural and plant layout drawings.

Because the aging management review differed for mechanical and electrical equipment, the scoping of mechanical and electrical systems was treated differently. For the purposes of system level scoping, plant electrical and instrumentation and control systems are included in the scope of license renewal. Electrical and instrumentation and control components in mechanical systems were included in the evaluation of electrical systems. See Section 2.5 for additional information on electrical scoping and screening.

For scoping, system boundaries were established in terms of the major intended functions they perform. This permitted the aging management reviews of several SAR described systems or portions of systems to be combined with other system reviews which in turn streamlined the integrated plant assessment process by reducing the number of individual system reviews. For example, the safety-related system-to-system boundary isolation valves of an otherwise nonsafety-related system, such as a drain system, were typically reviewed as part of the interfacing safety-related system. For further discussion, see Section 2.2.

The independent spent fuel storage installation structures and components were not included in the IPA, since they have separate licenses from the ANO-2 operating license. However, certain common systems, structures, and components that are shared by ANO-1 and ANO-2 were included in the ANO-2 IPA, since the systems and structures meet the criteria for being in scope for ANO-2.

License renewal drawings were prepared to indicate components subject to aging management review. Components that are subject to aging management review based only on the criterion of 10CFR54.4(a)(2) are not indicated on the drawings.

Functions for the structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. The applicable sections of the SAR, Technical Specifications, Maintenance Rule Scoping Documents, Upper Level Documents, and ANO topical reports for the NRC regulations identified in 10CFR54.4(a)(3) were used to determine system and structure functions.

Each mechanical system and structure was evaluated against the criteria of 10CFR54.4 as described in the following sections. The evaluation against the safety-related criterion in 10CFR54.4(a)(1) is described in Section 2.1.1.1. The evaluation against the nonsafety-related SSCs affecting safety-related SSCs criterion, 10CFR54.4(a)(2), is discussed in Section 2.1.1.2. The evaluation against the regulated events criterion, 10CFR54.4(a)(3), is discussed in Section 2.1.1.3. The results of these evaluations for plant systems and structures are presented in Section 2.2.

2.1.1.1 Application of Safety-Related Scoping Criteria

ANO-2 maintains a component level database which identifies the component safety classification. The safety-related, or Q, classification uses the same definition as that stated in 10CFR54.4. The ANO-2 definition of safety-related used to develop and maintain the component level Q-list includes the systems, structures, and components that are relied on to remain functional during or following design basis events to ensure

(1) the integrity of the reactor coolant pressure boundary,

(2) the capability to shutdown the reactor and maintain it in a safe shutdown condition, or

(3) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the guideline exposures of 10 CFR Part 100. (In addition to the guidelines of 10CFR100.11, the safety-related criterion of 10CFR54.4(a)(1)(iii) includes reference to the dose guidelines of 10CFR50.34(a)(1) and 10CFR50.67(b)(2). These guidelines, applicable to facilities seeking a construction permit and to facilities seeking to revise the current accident source term used in their design basis radiological analyses, respectively, are not applicable to ANO-2.)

The determination of the SSCs that perform safety functions was completed by a combination of a review of the ANO-2 component level Q-list and a review of the system and structure functions. If one or more of the three criteria were met, the function was determined to be a safety intended function and the corresponding system or structure was included within the scope of license renewal as safety-related. The plant design basis documents, including the SAR and the upper level design documents, were utilized to identify the system functions and verify the Q-list identification of safety-related components.

Because of plant-specific considerations or preferences, ANO elected to designate some components that do not perform any of the functions of 10CFR54.4(a)(1) as safety-related. Therefore, a component may not meet 10CFR54.4(a)(1), although it is designated as safety-related for plant-specific reasons. Very few components meet this exception. The systems and structures containing these components were still evaluated for inclusion in scope using the criteria in 10CFR54.4(a)(2) and 10CFR54.4(a)(3).

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

This review identified nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of a safety function. The impacts of nonsafety-related SSC failures were considered as either functional or spatial. In a functional failure, the failure of an SSC to perform its normal function impacts another safety function. In a spatial failure, a safety function is impacted by the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component.

2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

At ANO-2, with few exceptions, SSCs required to perform a function in support of other safety-related components are classified as safety-related and included in the scope of license renewal per Section 2.1.1.1. For the few exceptions where nonsafety-related equipment is required to remain functional in support of a safety function, the supporting systems are included in scope as nonsafety-related SSCs affecting safety related SSCs.

Engineering and licensing documents were considered to determine the appropriate systems and structures in this category. The applicable sections of the SAR, Technical Specifications, maintenance rule scoping documents, and design basis documents provided the system information to address these questions.

2.1.1.2.2 Spatial Failures of Nonsafety-Related SSCs

Based on the license renewal rule and the guidance in Reference 2.1-6, components meeting the scoping criterion of 10CFR54.4(a)(2) fit into the following categories:

(1) nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems); or

(2) nonsafety-related SSCs with the potential for spatial interaction with safety-related SSCs.

Nonsafety-related SSCs Directly Connected to Safety-related SSCs

For piping systems, the nonsafety-related piping and supports, up to and including the first equivalent anchor beyond the safety/nonsafety-related interface, are subject to aging management review. In addition, nonsafety-related portions of safety-related systems downstream of the first anchor are subject to aging management review if they have the potential for spatial interaction with safety-related SSCs.

Nonsafety-related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs

The following sections address the different modes of spatial interaction that were considered. Interactions can occur in the following forms:

- physical impact such as in a seismic event (Seismic II/I),
- pipe whip, jet impingement, or harsh environment resulting from a piping rupture, or
- damage due to leakage or spray from nonsafety-related SSCs.

Protective features (whip restraints, spray shields, supports, barriers, etc.) are installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs. Such protective features credited in the plant design are included within the scope of license renewal and are subject to aging management review. Where those protective features provide adequate protection, the nonsafety-related system itself is excluded from the scope of license renewal. Protective features are typically associated with a structure and are addressed in the structural aging management review.

Physical Impact

This category concerns potential spatial interaction of nonsafety-related SSCs falling on or otherwise physically impacting safety-related SSCs such that safety functions may not be accomplished.

Nonsafety-related supports for non-seismic or seismic II/I piping systems with a potential for spatial interaction with safety-related SSCs are subject to aging management review based on the criterion of 10CFR54.4(a)(2). These supports are addressed in a commodity fashion within the civil/structural section.

Based on earthquake experience data (Reference 2.1-7) that includes aged pipe, the following conclusions can be drawn.

- *No* experience data exists of welded steel pipe segments falling due to a strong motion earthquake.
- Falling of piping segments is extremely rare and only occurs when there is a failure of the supports.

As long as the effects of aging on the supports for piping systems are managed, falling of piping sections is not considered credible, and the piping section itself is not in scope for 10CFR54.4(a)(2) due to the physical impact hazard. The effects of spray and leakage were considered as discussed below.

Missiles can be generated from internal or external events such as failure of rotating equipment. Inherent nonsafety-related features that protect safety-related equipment from missiles require aging management review based on the criterion of 10CFR54.4(a)(2).

The overhead-handling systems, whose structural failure could result in damage to any system that could prevent the accomplishment of a safety function, meet the criteria of 10CFR54.4(a)(2) and are within the scope of license renewal.

Pipe Whip, Jet Impingement, or Harsh Environments

Pipe whip, jet impingement, and harsh environment effects on safety-related equipment are addressed in site-specific analyses of high and medium energy line breaks. As described in SAR Section 3.6, spatial interactions of pipe whip, jet impingement, and harsh environment were analyzed for high-energy systems. The effects of leakage, spray, or flooding were considered as discussed below.

If a high-energy line break (HELB) analysis assumes that a nonsafety-related piping system does not fail or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10CFR54.4(a)(2) and subject to aging management review in order to provide reasonable assurance that those assumptions remain valid through the period of extended operation.

Leakage, Spray, or Flooding

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

Air and gas (non-liquid) systems are not a hazard to other plant equipment. Components that do not contain liquids cannot adversely affect safety-related SSCs due to leakage or spray. Operating experience indicates that nonsafety-related systems containing only air or gas have experienced no failures due to aging that could impact the ability of safety-related equipment to perform required safety functions. There are no credible aging effects for these systems when the environment is a dry gas. These systems are not in the scope of license renewal for scoping criterion 10CFR54.4(a)(2).

For ANO-2, nonsafety-related systems and nonsafety-related portions of safety-related systems containing steam or liquid that are near safety-related equipment are considered in scope and subject to aging management review for 10CFR54.4(a)(2). In light of 10CFR54.4(a)(2), the concern for these systems is the impact of a pressure boundary failure on safety-related systems. These failures could result in the nonsafety-related piping spraying or leaking on safety-related equipment. Consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing basis and that have not been previously experienced is not required (Reference 2.1-8).

Long-term exposure to conditions resulting from a failed nonsafety-related SSC (such as leakage or spray) is not considered credible. Leakage or spray from liquid-filled low-energy systems is detected during routine operator rounds or system walkdowns long before it could impact the performance of safety-related equipment. The leakage from these low-energy systems has typically resulted from localized pitting that is not indicative of the overall condition of the piping.

Follow-up actions would direct leakage away from equipment and therefore prevent its failure. Additional evaluations of the condition of the piping would then be performed.

Walls, curbs, dikes, doors, etc., that provide flood barriers to safety-related SSCs require aging management review based on the criterion of 10CFR54.4(a)(2). These are included as part of the building structure and evaluated in the civil/structural aging management review.

2.1.1.3 Application of Criterion for Regulated Events

The scope of license renewal includes those systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10CFR50.48), environmental qualification (10CFR50.49), pressurized thermal shock (10CFR50.61), anticipated transients without scram (10CFR50.62), and station blackout (10CFR50.63). This section discusses the approach used to identify the systems and structures in the scope of license renewal based on this criterion. The systems and structures that perform intended functions in support of these regulated events are identified in the descriptions in Sections 2.3, 2.4, and 2.5.

2.1.1.3.1 Commission's Regulations for Fire Protection (10CFR50.48)

Systems and structures in the scope of license renewal for fire protection include equipment based on functional requirements defined in 10CFR50.48 and Appendix R. SSCs credited with fire prevention, detection and mitigation in areas containing equipment important to safe operation of the plant are in scope. To establish this scope of equipment, a detailed review of the ANO-2 current licensing basis for fire protection was performed. Based on the review of the current licensing basis for fire protection, the intended functions performed in support of 10CFR50.48 requirements were determined.

2.1.1.3.2 Commission's Regulations for Environmental Qualification (10CFR50.49)

10CFR50.49 defines electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that result in harsh environmental conditions in the plant. 10CFR50.49 codified requirements for the environmental qualification of electrical equipment that had been presented in other regulatory documents such as IE Bulletin 79-01B. The ANO-2 equipment qualification program satisfies these requirements.

As described in Section 2.1.1 of this application, a bounding scoping approach is used for electrical equipment. Electrical systems and electrical equipment in mechanical systems are by default included in scope for license renewal. Consequently, the environmentally qualified equipment is in scope for license renewal.

2.1.1.3.3 Commission's Regulations for Pressurized Thermal Shock (10CFR50.61)

The rule concerning pressurized thermal shock (PTS), 10CFR50.61, requires that licensees evaluate the reactor vessel beltline materials against specific criteria to ensure protection from brittle fracture. 10CFR50.61 specifies the calculational method to determine an analytical value, RT_{PTS}, which is compared to PTS screening criteria specified in the rule.

For ANO-2, the limiting reference temperatures after 60 years of operation are well below the screening criteria. (See Section 4.2.2 for further discussion.) As a result, no flux reduction programs or modifications to equipment, systems or operation are necessary to prevent potential failure of the reactor vessels. The only system relied upon to meet the PTS regulation is the reactor coolant system, which contains the reactor vessel. There are no structures relied upon to meet the PTS regulation.

2.1.1.3.4 Commission's Regulations for Anticipated Transients without Scram (10CFR50.62)

An ATWS is an anticipated operational occurrence that is accompanied by a failure of the reactor trip system to shut down the reactor. The ATWS rule, 10CFR50.62, requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event.

Based on the ANO-2 current licensing bases for ATWS, the intended functions supporting 10CFR50.62 requirements were determined. Since the scope of equipment required by 10CFR50.62 is from sensor output to the final actuation device, the plant systems that support compliance with the ATWS rule are electrical and instrumentation and control systems. As described in Section 2.1.1 of this application, a bounding scoping approach is used for electrical equipment. Electrical systems are by default included in scope for license renewal and electrical equipment in mechanical systems are evaluated with the electrical systems. Consequently, equipment that supports compliance with the ATWS rule is in scope for license renewal.

2.1.1.3.5 Commission's Regulations for Station Blackout (10CFR50.63)

10CFR50.63 requires that each light-water-cooled nuclear power plant be able to withstand and recover from a station blackout. A station blackout (SBO) is the loss of offsite and onsite AC electric power to the essential and non-essential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries. The objective of this requirement is to assure that nuclear power plants are capable of withstanding an SBO and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration.

At ANO-2 the equipment relied upon to support 10CFR50.63 is that required to ensure the reactor core is cooled and containment integrity is maintained using the station batteries and the alternate AC diesel before offsite or onsite AC power is restored. Systems and structures relied upon to restore the offsite AC power (including the on-site portion of the offsite power sources) and onsite AC power are conservatively included within the license renewal scope for SBO. In addition to the plant electrical systems, certain switchyard components, required to restore offsite power, were conservatively included even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10CFR50.63).

Based on the review of the ANO-2 current licensing bases for SBO, the equipment performing intended functions required for compliance with 10CFR50.63 was determined.

2.1.2 Screening Methodology

Screening is the process for determining which components and structural elements require aging management review. The requirement for screening is found in 10CFR54.21.

10CFR54.21(a) states

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

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

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

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

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

For a structural element or component in the scope of license renewal (i.e., a part of a structure or system within scope), the screening process determined whether it performs a component intended function without moving parts and without a change in configuration or properties (i.e., it is passive) and whether it is not subject to replacement based on a qualified life or specified time period (i.e., it is long-lived). The license renewal rule requires that the integrated plant assessment include a description and justification of the methods used to determine the "passive, long-lived" structural elements and components.

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

The ANO-2 process for evaluating consumables is consistent with the NRC staff guidance on consumables provided in a letter from C. I. Grimes, NRC, to D. J. Walters, NEI, dated March 10, 2000 (Reference 2.1-13).

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

2.1.2.1 Screening of Mechanical Systems

For each mechanical system within the scope of license renewal, the screening process identified those components that are subject to aging management review. Section 2.3 presents the results for mechanical systems.

2.1.2.1.1 Identifying Components Subject to Aging Management Review

Within the system, long-lived passive components that perform or support an intended function without moving parts or a change in configuration or properties are subject to aging management review.

In making the determination that a component is passive, it is not necessary to consider the piece parts of the component. However, in the case of valves, pumps, and housings for fans and dampers, the valve bodies, pump casings, and housings perform an intended function by maintaining the pressure boundary and therefore are subject to aging management review.

If the component is not subject to replacement based on qualified life or specified time period, then it is considered long-lived. Replacement programs are based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life or replacement frequency under a controlled program. Components that are not long-lived are not included in the aging management review.

2.1.2.2 Screening of Structures

For each structure within the scope of license renewal, the structural components and commodities were evaluated to determine those subject to aging management review. The screening process for structural components and commodities involved a review of design basis documents (drawings, etc.) to identify specific structural components and commodities that constitute the structure. Structural components or commodities subject to aging management review are those that perform an intended function without moving parts or a change in configuration or properties (i.e., passive), and are not subject to replacement based on qualified life or specified time period (i.e., long-lived). Since structures are inherently passive, and with few exceptions are long-lived, the screening of structural components and commodities was based primarily on whether they perform an intended function.

2.1.2.2.1 Structural Component and Commodity Groups

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

- Steel
- Threaded fasteners
- Concrete

- Fire barriers
- Elastomers
- Earthen structures
- Teflon

2.1.2.2.2 Evaluation Boundaries

Structural components and commodities that are attached to a structure or reside within a structure are generally categorized as either component supports or as other structural members.

Component Supports – Mechanical Components

The evaluation boundaries for mechanical component supports were established in accordance with rules governing inspection of component supports (i.e., ASME Section XI, Subsection IWF). Component support examination boundaries for integral and non-integral (i.e., mechanically attached) supports are defined in article IWF-3100, Figure IWF-1300-1. In general, the support boundary extends to the surface of the building structure, but does not include the building structure. Furthermore, the support boundary extends to include non-integral attachments to piping and equipment but excludes integral attachments to the same.

Component Supports – Electrical Components

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

Other Structural Members

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

2.1.2.2.3 Intended Function

Structural components and commodities were evaluated to determine intended functions as they relate to license renewal. Unlike mechanical equipment for which both system-level and component-level intended functions are defined, the intended functions for structures are typically based on a simple set of functions that apply both to the structure and to its components and commodities. NEI 95-10 (Reference 2.1-5) provides guidelines for determining the intended functions of structures, structural components and commodities for purposes of license renewal. These intended functions are included in Table 2.0-1.

2.1.2.3 Electrical and Instrumentation and Control Systems

2.1.2.3.1 Passive Screening

Regulatory Guide 1.188, (Reference 2.1-4), endorses NEI 95-10, Revision 3, by stating, “The NRC staff has reviewed this document [NEI 95-10] and found that it provides guidance acceptable to the staff.”

NEI 95-10, Appendix B, “Typical Structure, Component and Commodity Groupings and Active/Passive Determinations for the Integrated Plant Assessment”, identifies electrical commodities considered to be passive. The ANO-2 electrical commodity groups were identified and cross-referenced to the appropriate NEI 95-10 commodity, which identified the passive commodity groups.

Two passive electrical and I&C commodity groups were identified that meet the 10CFR54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration):

(1) cables and connections, bus, electrical portions of electrical and I&C penetration assemblies, and
(2) high voltage insulators.

Other electrical and I&C commodity groups are active and do not require aging management review.

Table 2.1-1 divides the aforementioned two commodity groups into seven separate commodity groupings. Because Table 2.1-1 and NEI 95-10 commodity groupings do not exactly match, the examples provided within Appendix B to NEI 95-10 have been included in Table 2.1-1 for clarity in comparisons with NEI 95-10.

Table 2.1-1
Standard List of Passive Electrical Commodities

Passive Electrical Commodities	Intended Function
Insulated cables and connections (e.g., power cables, control cables, instrument cables, communication cables, electrical splices, terminal blocks, fuse blocks)	To provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals.
Electrical portions of electrical and I&C penetration assemblies (e.g., electrical penetration assembly cables and connections)	
Phase bus (e.g., isolated-phase bus, segregated and non-segregated phase bus)	
Transmission conductors	
Switchyard bus	
High-voltage insulators (e.g., porcelain switchyard insulators, transmission line insulators)	To insulate and support an electrical conductor.
Uninsulated ground conductors (e.g. grounding rods, buried ground cables and cathodic protection)	To provide electrical connections to specified sections of an electrical circuit.

The pressure boundary function that may be associated with some electrical and I&C components identified in NEI 95-10 Appendix B (e.g., flow elements, vibration probes) was considered in the mechanical aging management reviews, as applicable. Electrical components are supported by structural commodities (e.g., cable trays, conduit and cable trenches), which are included in the structural aging management reviews.

2.1.2.3.2 Long-Lived Screening

Electrical components included in the environmental qualification (EQ) program per 10CFR50.49 are replaced based on qualified life and, therefore, do not meet the “long-lived” criterion of 10CFR54.21(a)(1)(ii) and are not subject to aging management review. Some insulated cables and connections and most electrical penetration assemblies are included in the EQ program and are not subject to aging management review. The non-EQ electrical penetration assemblies are subject to aging management review. The EQ insulated cables and connections group contains the electrical cables used in instrumentation circuits that are sensitive to a reduction in conductor insulation resistance, such as high range radiation monitors and neutron flux detectors. No other electrical components were screened out per the long-lived criterion. The result is that the aging management reviews involve only non-EQ electrical and I&C components.

EQ evaluations are time-limited aging analyses (TLAA) and are addressed in Section 4.4.

2.1.3 Interim Staff Guidance Discussion

As discussed in References 2.1-9 and 2.1-10, the NRC has encouraged applicants for license renewal to address proposed ISGs in the LRA.

The NRC staff has identified the following issues for which additional staff and industry guidance clarification may be necessary:

- ISG-1 GALL Report Presenting One Acceptable Way to Manage Aging Effects for License Renewal
- ISG-2 Scoping of Equipment Relied On to Meet the Requirements of the Station Blackout (SBO) Rule for License Renewal
- ISG-3 Aging Management Program of Concrete
- ISG-4 Aging Management of Fire Protection System for License Renewal
- ISG-5 Identification and Treatment of Electrical Fuse Holders for License Renewal
- ISG-6 Identification and Treatment of Housings for Active Components for License Renewal
- ISG-7 Scoping Guidance for Fire Protection Equipment for License Renewal
- ISG-8 Updating the Improved License Renewal Guidance Documents – ISG Process (This non-technical issue has been deleted from the ISG list.)
- ISG-9 Identification and Treatment of Structures, Systems and Components Which Meet 10CFR54.4(a)(2)
- ISG-10 Standardized Format for License Renewal Applications
- ISG-11 Aging Management of Environmental Fatigue for Carbon/Low-Alloy Steel
- ISG-12 Operating Experience with Cracking of Class 1 Small-Bore Piping
- ISG-13 Management of Loss of Preload on Reactor Vessel Internals Bolting Using the Loose Parts Monitoring System
- ISG-14 Operating Experience with Cracking in Bolting
- ISG-15 Revision to Generic Aging Lessons Learned Aging Management Program (AMP) XI.E2
- ISG-16 Time-Limited Aging Analyses Supporting Information for License Renewal Applications
- ISG-17 Bus Ducts (Iso-phase and Non-segregated) for Electrical Bus Bar
- ISG-18 Revision to GALL AMP XI.E3 for Inaccessible Cable (Medium Voltage)

ISG-12, ISG-13, ISG-14, ISG-17, and ISG-18 have been identified by the NRC but no guidance has been provided. Therefore these issues will not be addressed. The following is a discussion of each of the remaining active issues.

ISG-1 GALL Report Presenting One Acceptable Way to Manage Aging Effects for License Renewal

NUREG-1801 is used as a reference for Section 3.

ISG-2 Scoping of Equipment Relied On to Meet the Requirements of the Station Blackout (SBO) Rule for License Renewal

Scoping related to station blackout is discussed in Section 2.1.1.3.5. Scoping is in accordance with the ISG.

ISG-3 Aging Management Program of Concrete

Concrete subject to aging management review has been included in an aging management program in accordance with the ISG. This includes concrete for which no aging effects requiring management were identified. See Section 3.5.

ISG-4 Aging Management of Fire Protection System for License Renewal

This ISG dealt with three aspects of the fire protection (FP) system aging management program.

1. Wall thinning of FP piping due to internal corrosion

As stated in the ISG, disassembling portions of the FP piping as described in NUREG-1801 Chapter XI.M27 may not be the most effective means to detect this aging effect. The use of a non-intrusive means of evaluating wall thickness is recommended. The fire water system program will address the means of evaluating wall thickness.

2. Testing of Sprinkler Heads

The fire water system program will incorporate NFPA 25 sprinkler head testing guidance.

3. Valve Lineup Inspections of Halon/Carbon Dioxide Fire Suppression Systems.

The ISG states that valve lineup inspections, charging pressure inspections, and automatic mode of operation verifications for the halon/carbon dioxide system are operational activities pertaining to system or component configurations or properties that may change, and are not related to aging management.

Therefore, the staff position is to eliminate the halon/carbon dioxide system inspections for charging pressure, valve lineups, and automatic mode of operation. Accordingly, these inspections are not credited in the ANO-2 fire protection program.

ISG-5 Identification and Treatment of Electrical Fuse Holders for License Renewal

Fuse holders (including fuse clips and fuse blocks) are considered passive electrical components. Fuse holders (including fuse clips and fuse blocks) are included in the aging management review (AMR) in the same manner as terminal blocks and other types of electrical connections as described in Section 2.1.2.3. Consistent with ISG-5, fuse holders that are part of a larger assembly inside the enclosure of an active component, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are considered piece parts of the larger assembly. Since piece parts and sub-components in such an enclosure are inspected regularly and maintained as part of the normal maintenance and surveillance activities, and they are considered not subject to AMR.

Fuse holders are considered electrical connections (similar to terminal blocks) and are subject to GALL XI.E1 (see Section 3.6). However, visual inspection alone may not be sufficient to detect the aging effects for the metallic clips of the fuse holders. ISG-05 addresses fuse holders that are not part of a larger assembly but support safety functions and nonsafety functions in which a failure of a fuse precludes a safety function from being accomplished. There are no fuse holders meeting these criteria at ANO-2. Metallic clamp fuse holders installed at ANO-2 are either part of an active component installation or are located in circuits that are excluded from the requirement to perform an aging management review.

ISG-6 Identification and Treatment of Housings for Active Components for License Renewal

The process used to identify passive components subject to aging management review is discussed in Section 2.1.2.1. Consistent with the interim staff guidance this review identified active component housings (e.g., pump casings, valve bodies, and housings for fans and dampers) which are subject to aging management review.

ISG-7 Scoping Guidance for Fire Protection Equipment for License Renewal

Scoping for fire protection systems, structures and components was determined by a review of the current licensing basis for ANO-2. The scoping and screening results are discussed in Section 2.3.3.2.

ISG-9 Identification and Treatment of Structures, Systems and Components Which Meet 10CFR54(a)(2)

10CFR54.4(a)(2) states that SSCs within the scope of license renewal shall include nonsafety-related SSCs whose failure could prevent the satisfactory accomplishment of any of the functions identified for safety-related SSCs.

The process that was used to identify the in-scope nonsafety-related SSCs under 10CFR54.4(a)(2) is discussed in Section 2.1.1.2.

ISG-10 Standardized Format for License Renewal Applications

The NEI standard license renewal application format was considered during the preparation of the LRA.

ISG-11 Aging Management of Environmental Fatigue for Carbon/Low-Alloy Steel

Aging management of environmental fatigue for carbon/low-alloy steel items is discussed in Section 4.3.3.1.

ISG-15 Revision to Generic Aging Lessons Learned Aging Management Program (AMP) XI.E2

NUREG-1801, Volume 2, Section XI.E2, Electrical Cables Not Subject to 10CFR50.49 Environmental Qualification Requirements Used in Instrumentation Circuits, identifies a calibration program for instrumentation circuits as the means of detecting aging effects in non-EQ instrumentation circuits. The referenced program, and consequently ISG-15, are not required at ANO-2, since the cables and connections used in these instrumentation circuits are EQ, and therefore not subject to aging management review.

ISG-16 Time-Limited Aging Analyses Supporting Information for License Renewal Applications

ISG-16 addresses the level of detail of supporting information to be provided in a license renewal application in the discussion of time-limited aging analysis evaluations. Section 4 documents the evaluation of time-limited aging analyses. ISG-16 was considered in developing Section 4; however, since ISG-16 is a draft, each provision of the ISG was not necessarily incorporated.

ISG-12, ISG-13, ISG-14, ISG-17, and ISG-18 have been identified by the NRC but no guidance has been provided. Therefore, these issues are not addressed in this section.

2.1.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10, review of NRC generic safety issues as a part of the license renewal process is required to satisfy the finding required by 10CFR54.29. GSIs that involve an issue related to the license renewal aging management review or time-limited aging analysis evaluations are to be addressed in the LRA. Based on NUREG-0933 (Reference 2.1-3), Entergy Operations has identified the following GSIs to be addressed in this application.

GSI 168 – Environmental Qualification of Electrical Equipment

This GSI is related to aging concerns for equipment that is subject to the environmental qualification requirements of 10CFR50.49. Environmental qualification evaluations of electrical equipment are identified as time-limited aging analyses for ANO-2. Accordingly, this GSI is addressed in Section 4.4.

GSI-188, Steam Generator Tube Leaks / Ruptures Concurrent with Containment Bypass

The issue stems from operating and test experience which suggested that a main steam line break in a PWR can cause resonant vibration of steam generator tubes. This vibration raised the possibility of steam generator tubes rupturing during the course of an accident initiated by a main steam line break. This is a CLB issue that is not related to license renewal aging management reviews or time-limited aging analysis evaluations. Therefore, GSI-188 is not addressed in this application.

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 2.1-11). In the closure letter, however, the NRC concluded that licensees should address the effects of reactor coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. Accordingly, the issue of environmental effects on component fatigue life is addressed in Section 4.3.3.1.

GSI 191 – Assessment of Debris Accumulation on PWR Sump Performance

The issue is the potential impact on emergency core cooling system performance caused by blockage of containment sump screens by debris, especially failed coatings. Refer to the response to NRC Generic Letter 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment" (Reference 2.1-12). In accordance with the ANO response to Generic Letter 98-04, failure of coatings in the ANO-2 containment is not expected to prevent accomplishment of required safety functions. In addition, ANO-2 does not credit coatings to assure that intended functions of coated SCs are maintained. Therefore, coatings have no license renewal intended function and are not subject to aging management review.

2.1.5 Conclusion

The methods described in Sections 2.1.1 and 2.1.2 were used at ANO-2 to identify the systems, structures, and components that are within the scope of license renewal and to identify those structures and components requiring aging management review. The methods are consistent with and satisfy the requirements of 10CFR54.4 and 10CFR54.21(a)(1).

2.1.6 References for Section 2.1

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

2.1-2 U. S. Nuclear Regulatory Commission, NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* July 2001.

2.1-3 U. S. Nuclear Regulatory Commission, NUREG-0933, *A Prioritization of Generic Safety Issues*, Supplement 25, June 2001.

2.1-4 U. S. Nuclear Regulatory Commission, Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses,” July 2001.

2.1-5 Nuclear Energy Institute, NEI 95-10, *Industry Guideline on Implementing the Requirements of 10 CFR Part 54, The License Renewal Rule*, Revision 3, April 2001.

2.1-6 Grimes, Chris (NRC) to Alan Nelson (NEI) and D. Lockbaum (UCS), “License Renewal Issue: Guidance on the Identification and Treatment of Structures, Systems, and Components which Meet 10CFR54.4(a)(2),” letter dated March 15, 2002.

2.1-7 NUREG/CR-6239, “Survey of Strong Motion Earthquake Effects on Thermal Power Plants in California with Emphasis on Piping Systems,” U. S. Nuclear Regulatory Commission, dated November 19, 1995.

2.1-8 Grimes, Chris (NRC) to Alan Nelson (NEI), “License Renewal Issue: Scoping of Seismic II/I Piping Systems,” letter dated December 3, 2001.

2.1-9 Nelson, Alan (NEI) to P. T. Kuo (NRC), “U.S. Nuclear Industry’s Proposed Standard License Renewal Application Format Package,” letter dated January 24, 2003.

2.1-10 Kang, Peter J (NRC) to Nuclear Energy Institute, “Summary of Meeting with the Nuclear Energy Institute (NEI) on the Status of Interim Staff Guidance (ISG) for License Renewal,” meeting summary dated February 21, 2003.

2.1-11 Thadani, A., Director, Office of Nuclear Regulatory Research, to W. Travers, Executive Director of Operations: Closeout of Generic Safety Issue 190, "Fatigue Evaluation of Metal Components for 60 Year Plant Life," NRC memorandum dated December 26, 1999.

2.1-12 ANO to NRC, "Generic Letter 98-04: Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," letter dated November 11, 1998.

2.1-13 Grimes, Chris (NRC) to D. J. Walters (NEI), "License Renewal Issue No. 98-12, Consumables," letter dated March 10, 2000.

2.2 PLANT LEVEL SCOPING RESULTS

Tables 2.2-1a, 2.2-1b, and 2.2-3 list the mechanical systems, electrical systems, and structures, respectively, that are within the scope of license renewal for ANO-2. For mechanical systems, a reference is given to the section of the application that provides a description of the system. For electrical systems, no description is necessary since electrical systems are in scope by default (see Section 2.5). For structures, a reference is given to the section that includes the structure in the screening results.

Tables 2.2-2 and 2.2-4 list the systems and structures, respectively, that do not meet the criteria specified in 10CFR54.4(a) and are therefore excluded from the scope of license renewal. For each item on these lists, the table also provides a reference (if applicable) to the section of the Safety Analysis Report (SAR) that describes the system or structure.

The list of systems used in these tables is based on the system codes used in the ANO component database. The scoping and screening results presented in Section 2.3 for mechanical systems are based on the grouped systems used for the aging management reviews. These grouped systems are referred to as “AMR systems” as necessary to distinguish them from system codes. For the mechanical system codes in Table 2.2-1a, a reference is provided to the section that gives a description of the system. For example, both HPSI and LPSI refer to Section 2.3.2.1, Emergency Core Cooling. The emergency core cooling system is an AMR system that does not appear in the list of system codes in Table 2.2-1a. The HPSI and LPSI systems were evaluated together since they share the key intended function of emergency core cooling following a loss of coolant accident.

If components from a system code are evaluated with more than one AMR system, the description referenced from Table 2.2-1a discusses which AMR systems include these components. For example, the description of the emergency feedwater (EFW) system in Section 2.3.4.3 states that certain EFW valves are evaluated with the service water system. Conversely, the service water system description in Section 2.3.3.8 explains that certain EFW valves are included in the service water evaluation.

The component database system codes are not always the same as the system acronyms used in the SAR. For example, the SAR uses system acronyms of primary sampling system (PSS), secondary sampling system (SSS) and waste gas analyzer system (WGAS) when it describes the sampling systems at ANO. The component database uses system codes of primary sampling (PS) and sampling system (SS) and the waste gas sampling components are included in the SS system code.

For each AMR system, components subject to aging management review are highlighted on license renewal drawings. The highlighted drawings indicate the evaluation boundaries of the AMR systems.

Table 2.2-1a
Mechanical Systems within the Scope of License Renewal

Table 2.2-1a		
System Code	**System**	**LRA Section**
AAC	Alternate AC Generator	Section 2.3.3.4, Alternate AC Diesel Generator
ABHV	Auxiliary Building Heating and Ventilation	Section 2.3.3.9, Auxiliary Building Ventilation
ABS	Auxiliary Building Sump	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)2
AC	Chilled Water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
ACW	Auxiliary Cooling Water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
AS	Auxiliary Steam	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
BA	Breathing Air	Section 2.3.2.4, Containment Penetrations[1]
BD	Startup and Blowdown Demineralizers	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)2
BMS	Boron Management	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)2
BS	Containment Spray	Section 2.3.2.2, Containment Spray
CA	Chemical Addition	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)2
CCW	Component Cooling Water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)2
CEDM	Control Element Drive Mechanisms	Section 2.3.1, Reactor Coolant
CRV	Control Room Ventilation	Section 2.3.3.10, Control Room Ventilation
CT	Condensate Storage and Transfer	Section 2.3.4.3, Emergency Feedwater

Table 2.2-1a (Continued)

System Code	System	LRA Section
CVCS	Chemical and Volume Control	Section 2.3.3.5, Chemical and Volume Control
CVH	Containment Vent Header	Section 2.3.2.4, Containment Penetrations[1]
CW	Circulating Water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
DCH	Drain Collection Header	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
DW	Domestic Water	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
EDG	Emergency Diesel Generator	Section 2.3.3.3, Emergency Diesel Generator
EFW	Emergency Feedwater	Section 2.3.4.3, Emergency Feedwater
FH/FHS	Fuel Handling	Section 2.3.3.1, Spent Fuel Pool Cooling
FO	Fuel Oil	Section 2.3.3.7, Fuel Oil
FP	Fuel Pool Cooling and Purification	Section 2.3.3.1, Spent Fuel Pool Cooling
FS	Fire Protection (Water)	Section 2.3.3.2, Water Suppression Fire Protection
FW	Feedwater	Section 2.3.4.2, Main Feedwater
HAL	Halon System	Section 2.3.3.6, Halon and RCP Oil Collection
HPA	Hydrogen Purge	Section 2.3.2.5, Hydrogen Control
HPSI	High Pressure Safety Injection	Section 2.3.2.1, Emergency Core Cooling
IA	Instrument Air	Section 2.3.2.4, Containment Penetrations[1]
IS	Intake Structure [Ventilation]	Section 2.3.3.12, Other Miscellaneous Systems
LPSI	Low Pressure Safety Injection	Section 2.3.2.1, Emergency Core Cooling
LRW	Liquid Radwaste Management	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)

Table 2.2-1a (Continued)		
System Code	**System**	**LRA Section**
MS	Main Steam	Section 2.3.4.1, Main Steam
N2	Nitrogen Supply	Section 2.3.3.12, Other Miscellaneous Systems
PA	Reactor Building Purge Air	Section 2.3.2.3, Containment Cooling
PASS	Post Accident Sampling System	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
PH	Plant Heating	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
PS	Primary Sampling	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
RB	Reactor Building	Section 2.3.2.4, Containment Penetrations[1]
RBHV	Reactor Building Heating and Ventilation	Section 2.3.2.3, Containment Cooling
RCP	Reactor Coolant Pump	Section 2.3.1, Reactor Coolant
RCS	Reactor Coolant System	Section 2.3.1, Reactor Coolant
RT	Resin Transfer	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
RX	Reactor Core System	Section 2.3.1, Reactor Coolant
RZ	Regenerative Waste	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
SA	Service Air	Section 2.3.3.12, Other Miscellaneous Systems
SDC	Shutdown Cooling	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
SFP	Spent Fuel Pool	Section 2.3.3.1, Spent Fuel Pool
SGS	Steam Generator Secondary / Blowdown	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)

Table 2.2-1a (Continued)		
System Code	**System**	**LRA Section**
SS	Sampling System	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
SW	Service Water	Section 2.3.3.8, Service Water
SZ	Spent Resin	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
TBS	Turbine Building Sump	Section 2.3.3.11, Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
TS	Traveling Screen Wash	Section 2.3.3.12, Other Miscellaneous Systems
VENT	Ventilation System	Section 2.3.3.12, Other Miscellaneous Systems

[1] System descriptions are not provided for systems that are within the scope of license renewal only for containment penetrations.

Table 2.2-1b
Electrical Systems within the Scope of License Renewal
(Bounding Approach)

Because of the bounding approach used for scoping electrical and I&C equipment, all electrical and I&C commodities contained in electrical and mechanical systems are in scope by default. Table 2.2-1b provides the list of electrical systems that do not include mechanical components that meet the scoping criteria of 10CFR54.4. Systems with mechanical components that meet the scoping criteria of 10CFR54.4 are listed in Table 2.2-1a. Descriptions of each electrical system are not provided. SAR Chapters 7 and 8 describe I&C and electrical systems. For further information, see Section 2.5, Scoping and Screening Results: Electrical and Instrumentation and Controls Systems.

Table 2.2-1b	
System Code	**System**
2A	4.16 KV Switchgear
2B	480 V Load Center
2D	DC Power System
2H	6.9 KV Switchgear
2HT	Heat Tracing System
2K	Annunciator System
2LA	120 V AC System
2Y	120 V Instrument AC System
ARMS	Area Radiation Monitoring System
COMM	Communications
CP	Cathodic Protection System
CPC	Core Protection Calculator
DFAS	Diverse Emergency Feedwater Actuation
DSS	Diverse Scram System
EC	Plant Computer System
EL	Emergency Lighting
ES	Engineered Safety Features Actuation System
EXCT	Main Generator Excitation System
FD	Fire Detection System

Table 2.2-1b (Continued)	
System Code	**System**
F	500 KV System
FWCS	Feedwater Control System
HR	Hydrogen Recombiners
IB	Isophase Bus System
IC	Incore Instrumentation
ICC	Inadequate Core Cooling System
NI	Nuclear Instrumentation
PPS	Plant Protection System
RADS	Remote Acquisition and Data System
RDAC	Radiological Dose Assessment Computer
RMS	Radiation Monitoring System
RPS	Reactor Protection System
RRS	Reactor Regulating System
SMS	Seismic Monitoring System
SPDS	Safety Parameter Display System
VLPM	Vibration and Loose Parts Monitoring
XFMR	Main, Unit Auxiliary, Startup Transformers
SWYD	Offsite Power

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

Table 2.2-2		
System Code	**System**	**SAR Reference**
ADHV	Administration Building Heating and Ventilation	None
CO2/CRDX	Carbon Dioxide	Section 9.5.1.2.2
CPV	Containment Penetration Room Ventilation	Section 6.5
CS	Condensate	Section 10.4.7
DFS	Dry Fuel Storage	Section 9.1.2A
ED	Diesel Fuel Services	None
EHC	Electro-Hydraulic Control	Section 10.2.2.2
EOF	Emergency Operations Facility	None
EX	Extraction Steam	Section 10.2
GCH	Gas Collection Header	Section 11.3
GG	Generator Gas	Section 10.2.2.1
GS	Gland Steam / Exhaust Steam	Section 10.4.3
GSO	Generator Seal Oil	Section 10.2.2.1
GZ	Gaseous Radwaste	Section 11.3
H2	Hydrogen Supply (Generator)	Section 10.2.2.1
HD	Heater Drains	Section 10.4.7
IBC	Isophase Bus Cooling	Section 8.3.1.1.1
LLRW	Low Level Radwaste	None
LO	Lube Oil	Section 10.2.2.1
LRBV	Low Level Radwaste Building Ventilation	Section 11.5.6
MET	Meteorological	Section 2.3.3.4

Table 2.2-2 (Continued)

System Code	System	SAR Reference
MISC	Miscellaneous	None
NT	Neutralizing Tank	Section 9.2.3.2
PMU	Plant Makeup	Section 9.2.3
RDAC	Radiological Dose Assessment Computer	Sections 11.4.2.2.4 and 11.5.6
RMS	Radiological Monitoring System	Section 11.4
RS	Reheat Steam	Section 10.1
RWB	Radwaste Building	Section 11.5.6
SEC	Security System	Section 13.6
STP	Sewage Treatment Plant	Section 9.2.4.2
SU	Startup Boiler	None
SWC	Generator Stator Cooling	Section 10.2.2.1
TBV	Turbine Building Ventilation	Section 9.4.4
TG	Turbine Generator	Section 10.2
VS	Condenser Vacuum System	Section 10.4.2

Table 2.2-3
Structures within the Scope of License Renewal

Table 2.2-3	
Structure	**Screening Results**
Alternate AC diesel generator building	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Auxiliary building	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Condensate storage tank T-41B foundation and pipe trenches	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Containment building	Section 2.4.1, Containment and Containment Internals
Electrical manholes	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Emergency cooling pond	Section 2.4.3, Intake Structure and Emergency Cooling Pond
Emergency diesel fuel oil storage tank vault	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Fire fighting equipment hose reels	Section 2.4.4, Bulk Commodities
Fuel handling / refueling machines	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Fuel oil storage tank (T-25) foundation	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Intake canal	Section 2.4.3, Intake Structure and Emergency Cooling Pond
Intake structure	Section 2.4.3, Intake Structure and Emergency Cooling Pond
Pipe hangers – plant systems	Section 2.4.4, Bulk Commodities
Polar crane	Section 2.4.1, Containment and Containment Internals
Post-accident sampling system building	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures

Table 2.2-3 (Continued)	
Structure	**Screening Results**
Refueling water tank (2T3) foundation	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Switchyard / transformer yard	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures
Turbine building	Section 2.4.2, Auxiliary Building, Turbine Building and Yard Structures

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

Table 2.2-4	
Structure	**SAR Reference**
Administration building	None
Boathouse	None
Caustic acid building	None
Central support building	None
Chemical flush discharge pond	None
Chemical treatment building	None
Condensate storage tanks 2T41A and 2T41B foundation and pipe trenches	Section 9.2.6
Controlled access #3	None
Cooling tower, pump house, and cooling tower water treatment building	Sections 1.2.2.9 and 2.2.2.2
Crafts fabrication shop	None
Deluge valve pit and deluge building	None
Discharge canal	Section 2.4.8
Dry fuel storage	Section 9.1.2A
Engineering building	None
Emergency operations facility	None
Fire training building	None
Generation support building	None
Guard houses and security structures	None
H2, CO2 and bottle storage building	None
Maintenance facility	None

Table 2.2-4 (Continued)	
Structure	**SAR Reference**
Meteorological tower	Section 2.3.3
Miscellaneous tank foundations	None
Oily water separator building	None
Radwaste storage building	Section 11.5.6
Service water corrosion inhibitor building	None
Sodium bromide and sodium hypochlorite building	None
Start-up boiler building	None
Steam generator storage facility	None
Sullair compressor building	None
Technical support building	None
Vacuum degasifier building	None
Warehouses, paint storage building, pipe fabrication shops, etc.	None

2.3 SYSTEM SCOPING AND SCREENING RESULTS: MECHANICAL

2.3.1 Reactor Coolant System

System Description

The reactor coolant system (RCS) is described in SAR Section 5.1. The RCS is designed to transport heat from the reactor core to the steam generators. The RCS consists of two similar heat transfer loops connected in parallel to the reactor vessel. Each loop contains one hot leg, two cold legs, two reactor coolant pumps (RCPs) and a steam generator. In addition, the system includes a pressurizer, quench tank, and the necessary interconnecting piping and instrumentation.

Overpressure protection is provided by two spring-loaded safety valves connected to the top of the pressurizer. These valves discharge to the quench tank.

Components and piping in the RCS are insulated with a material compatible with the temperatures involved to reduce heat loss. Insulation material used for RCS components has low soluble chloride and other halide content to minimize the possibility of stress corrosion cracking of stainless steel.

As a safety-related system, the RCS is within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The RCS contains nonsafety-related components whose failure could impact safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(2). Components in the RCS perform functions that demonstrate compliance with the Commission’s regulations for pressurized thermal shock, station blackout, anticipated transient without scram, environmental qualifications, and fire protection and the RCS is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(3).

The RCS intended function "provide a pressure and fission product barrier" was used to establish the RCS Class 1 evaluation boundary. The RCS Class 1 evaluation boundary corresponds to

- RCS pressure boundary components within the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, IWB inspection boundary (1992 including portions of 1993 addenda),
- steam generator secondary nozzles and shell inspected in accordance with ASME Section XI, Subsection IWC,
- the non-Class 1 instrumentation and vent lines attached to RCS components, and
- the reactor vessel internals.

Components within the RCS Class 1 evaluation boundary are hereafter referred to as Class 1 components.

SAR References

Chapter 5 discusses the reactor coolant system. Section 5.1 provides a general description. Other SAR references are provided in the component descriptions below.

Components Subject to AMR

Tables 2.3.1-1 through 2.3.1-5 list the RCS components/items that require aging management review and their intended functions.

Tables 3.1.2-1 through 3.1.2-5 provide the results of the aging management review for the RCS Class 1 components.

The following Class 1 components support RCS system intended functions and are subject to aging management review.

- reactor vessel and control element drive mechanism pressure boundary (Section 2.3.1.1)
- reactor vessel internals (Section 2.3.1.2)
- class 1 piping, valves, and reactor coolant pumps (Section 2.3.1.3)
- pressurizer (Section 2.3.1.4)
- steam generators (Section 2.3.1.5)

The control element drive mechanism (CEDM) system is included in its entirety with the RCS evaluation. The reactor core system, which is included in the RCS evaluation, consists of fuel assemblies and the neutron source assemblies. These are not subject to aging management review because they are periodically replaced.

The RCS Class 1 piping evaluation boundary extends into portions of systems attached to the RCS. The Class 1 components of the systems listed below are evaluated with the RCS. The non-Class 1 portions of the systems listed below are evaluated in the referenced sections:

- high pressure safety injection (Section 2.3.2.1)
- low pressure safety injection (Section 2.3.2.1)
- chemical and volume control system (Section 2.3.3.5)
- primary sampling system (Section 2.3.3.11)

Containment penetrations in the RCS system that perform a containment isolation function are evaluated in Section 2.3.2.4. Components associated with the reactor coolant pump oil collection system are evaluated in Section 2.3.3.6. The quench tank and other nonsafety-related portions of the RCS, including certain components associated with the reactor coolant pumps, have no system intended functions other than to maintain mechanical/structural integrity so that nearby safety-related equipment is not adversely affected. These components are evaluated in Section 2.3.3.11. Reactor coolant system supports are evaluated in Section 2.4.4 of the application.

License Renewal Drawings

LRA-M-2230 Sh. 1	LRA-M-2232 Sh. 1
LRA-M-2230 Sh. 2	LRA-M-2237 Sh. 1
LRA-M-2231 Sh. 1	LRA-M-2238 Sh. 1

2.3.1.1 Reactor Vessel and Control Element Drive Mechanism Pressure Boundary

The ANO-2 reactor vessel and control element drive mechanism (CEDM) pressure boundary items subject to aging management review include the closure head, closure head flange, closure stud assemblies, vessel flange, upper, intermediate and lower shells, core stabilizing and stop lugs, core barrel support ledge, vessel supports, bottom head, primary coolant nozzles and safe ends, pressure boundary subcomponents of the CEDMs, CEDM nozzles, instrumentation nozzles, surveillance capsule holders, flow skirt, and vent line. The vessel contains the nuclear fuel core, core support structures, control rods, and other parts directly associated with the core.

The reactor vessel closure is sealed by two hollow metallic O-rings. Seal leakage is detected by means of two leak-off connections, one between the inner and outer ring and one outside the outer O-ring. The O-rings do not support an intended function of the reactor vessel and are therefore not subject to aging management review.

The reactor vessel internals are discussed in Section 2.3.1.2 and the reactor coolant system piping attached to reactor vessel safe ends is discussed in Section 2.3.1.3. SAR Section 5.4.6, Reactor Vessel Design Data, provides additional information regarding the reactor vessel. SAR Section 4.2.3, Reactivity Control Systems, provides additional information regarding the control element drive mechanisms. The mechanical components and component functions for the reactor vessel and pressure boundary subcomponents of the control element drive mechanisms are listed in Table 2.3.1-1.

2.3.1.2 Reactor Vessel Internals

The reactor vessel internals are designed to support and orient the reactor core and control element assemblies, direct the reactor coolant flow from the core, and guide the incore instrumentation. The reactor vessel internals subject to aging management review include the upper internals assembly, control element assembly shroud assemblies, core support barrel assembly, core shroud assembly, lower internals assembly, and incore instrumentation.

SAR Section 4.2.2, Reactor Internals, provides additional information regarding the ANO-2 reactor vessel internals. The mechanical components, component functions, and materials of construction for the reactor vessel internals are listed in Table 2.3.1-2.

2.3.1.3 Class 1 Piping, Valves, and Reactor Coolant Pumps

The following reactor coolant system Class 1 piping and associated pressure boundary components are subject to aging management review.

- hot and cold leg straight sections and elbows
- surge line straight sections and elbows
- spray line, safety injection, pressurizer safety/relief and letdown piping straight sections and elbows
- vent, drain and sampling piping straight sections and elbows
- reactor vessel leak detection lines
- charging, letdown, and drain nozzles
- safety injection nozzles
- RTD/temperature, replacement pressure nozzles, and pressure measurement and sampling nozzles
- nozzle thermal sleeves
- nozzle safe ends and inserts
- safety injection and charging nozzle thermal sleeves
- welds
- flow orifices
- reactor coolant pumps
- valves

Certain Class 1 valve subcomponents are not subject to aging management review because they are not passive components, i.e., performance of their intended functions requires moving parts or a change in configuration. These are the valve disks, stems, yokes, and operators. Pressure-retaining portions of Class 1 valves consist of the valve body bonnet and closure bolting.

The principle pressure boundary sub-components of the reactor coolant pumps are the casing, cover/thermal barrier, driver mount assembly, heat exchanger, seal cartridge, and studs/nuts. Although the pump seal cartridges are part of the pressure boundary and are in the scope of license renewal, an aging management review is not required since the seal cartridges are periodically monitored, inspected, and replaced. The remaining RCP subcomponents are not subject to aging management review since they do not perform their intended functions without moving parts. This includes items such as the impeller, shaft and journal, radial bearing, and coupling.

Small portions of reactor coolant system instrumentation and sampling tubing have been included within this section. This includes reactor coolant pressure boundary items (valves and tubing) downstream of instrument root valves.

SAR Section 5.5.1, Reactor Coolant Pumps, Section 5.5.3, Reactor Coolant Piping, Section 5.5.12, Valves, and Section 5.5.13, Safety and Relief Valves, provide additional information regarding the ANO-2 Class 1 piping, valves, and reactor coolant pumps. The mechanical components, component functions, and materials of construction for Class 1 piping, valves, and reactor coolant pumps are listed in Table 2.3.1-3.

2.3.1.4 Pressurizer

The pressurizer pressure boundary items include the vessel, attached nozzles, and safe ends out to the connection with RCS piping. Valves (i.e., safety and relief), instrument lines, and other piping connected to the pressurizer are discussed in Section 2.3.1.3.

The following pressurizer subcomponents support the RCS pressure boundary and are subject to aging management review.

- upper and lower shell, upper head
- lower head (including internal integral attachment for heater support plates)
- manway assembly (including cover plate, gasket retainer plate, studs and nuts)
- pressurizer surge, spray, and safety/relief nozzles and safe ends
- temperature, pressure, level nozzles and, safe ends
- nozzle inserts, flanges, and thermal sleeves
- heater sheath, sleeve, and end plug
- heater support plates and bolting
- heater penetration plugs
- pressurizer support skirt

The following pressurizer subcomponents are not subject to aging management review since they do not support an intended function of the pressurizer, do not perform intended functions without moving parts or a change in configuration, or are considered consumable items.

- spray head reducer assembly, bolting, nozzle, and hex nut
- gaskets (spray nozzle, MNSAs)
- surge nozzle screen assemblies
- heater elements

In 2002, six pressurizer heater sleeves were repaired using mechanical nozzle seal assemblies (MNSAs). These assemblies replace the function of the partial penetration J-groove welds that attach the heater sleeves to the pressurizer, moving the reactor coolant pressure boundary to the pressurizer exterior surface. The MNSAs consist of two split-seal/flange assemblies placed in a counter-bore around the leaking heater sleeve. The seal is held under compression by a compression collar which is held in place by threaded rods placed into holes drilled and tapped into the bottom head of the pressurizer. The MNSA items subject to aging management review include the compression collar, the upper flanges, and the bolting (threaded rods, nuts, and washers).

The intended function applicable to the pressurizer components is to maintain the pressure boundary so that the reactor coolant system may perform its system functions for the period of extended operation. However, a second intended function to consider is RCS pressure control. The pressurizer components provide RCS pressure control for mitigation of a feedwater line break (FWLB) with AC available as described in SAR Section 15.1.14.2.2.2. However, the most limiting FWLB is without AC power available and the pressurizer sprays are not credited to mitigate that event. Therefore, RCS pressure control using the pressurizer sprays is not an intended function of the pressurizer. Pressurizer heaters are required to maintain subcooling following loss of offsite power as described in SAR Section 5.5.10.2. However, the electrical heater elements are active and not subject to aging management review.

2.3.1.5 Steam Generators

The following ANO-2 steam generator components are subject to aging management review.

- tube plate
- U-tubes
- channel head
- channel head divider plate
- primary manway cover and insert plate
- primary nozzles, safe ends, and closure rings
- bolting
- tube support plates
- wrapper
- anti-vibration bars (AVBs), AVB bar end caps, and end cap welds
- U-bend peripheral retaining rings, retainer bars, retainer bar welds
- feedwater and steam outlet nozzle
- upper and lower shell barrels, elliptical heads, and transition cones
- feedwater thermal sleeves
- secondary manway covers
- hand hole covers
- inspection port covers and diaphragms
- blowdown and sampling nozzles
- instrument taps
- stay rods, spacer pipes, and hex nuts
- integral flow restrictors (venturis)

- snubber lugs and key brackets
- tube plugs

The following steam generator components are not subject to aging management review since they do not support an intended function of the steam generator or are considered consumable items.

- gaskets
- primary and secondary moisture separation equipment and associated supports and decking
- sludge collector assembly
- feedwater distribution ring pipe and fittings

The steam generator intended functions which form the basis for inclusion into the scope of license renewal include maintenance of the primary pressure boundary, maintenance of the secondary pressure boundary, heat transfer from the primary fluid to the secondary fluid, and flow control.

2.3.1.6 References for Section 2.3.1

2.3.1-1 Arkansas Nuclear One Unit 2 Safety Analysis Report, Amendment 17.

Table 2.3.1-1
Reactor Vessel and CEDM Pressure Boundary
Components Subject to Aging Management Review

Table 2.3.1-1	
Component Type	**Intended Function**
Interior and Exterior Attachments	
Closure head lifting lugs	SSR
Closure studs, nuts, and washers	Pressure boundary
Core stabilizing lugs	Core support
Core stop lugs Flow skirt	Pressure boundary
Grayloc clamp	Pressure boundary
Grayloc clamp studs Grayloc clamp nuts	Pressure boundary
ICI drive nuts ICI spacer sleeves	Pressure boundary
Reactor vessel support pads Shear lugs	SSR
Surveillance capsule holders	Pressure boundary
Penetrations	
CEDM motor housing CEDM upper pressure housing CEDM ball seal housing CEDM upper pressure housing upper fitting	Pressure boundary

Table 2.3.1-1 (Continued)	
Component Type	**Intended Function**
CEDM motor housing upper and lower end fittings CEDM upper pressure housing lower fitting	Pressure boundary
CEDM nozzle ICI nozzle tubes	Pressure boundary
CEDM steel ball	Pressure boundary
ICI flange adapter/ seal plate	Pressure boundary
Reactor vessel vent pipe	Pressure boundary
Reactor vessel vent pipe flange	Pressure boundary
Reactor Vessel Shell and Nozzles	
Bottom head (torus and dome) Upper shell	Pressure boundary
Closure head dome (torus and dome)	Pressure boundary
Closure head flange	Pressure boundary
Intermediate shell Lower shell	Pressure boundary
Primary inlet nozzles Primary outlet nozzles	Pressure boundary
Primary inlet nozzle safe ends Primary outlet nozzle safe ends	Pressure boundary
Vessel flange	Pressure boundary

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

Table 2.3.1-2	
Component Type	**Intended Function**
Control Element Assembly Shroud Assembly	
CEA instrument tube CEA shroud adapter CEA shroud support Positioning plate	CS, CEAS, FD, INS
CEA shroud extension shaft guides, cylinders, and bases CEA shroud base CEA shroud flow channel CEA shroud flow channel cap CEA shroud shaft retention pin CEA shroud retention block External spanner nut Internal spanner nut CEA shroud fasteners	CS, CEAS, FD, INS
CEA shroud flow channel extension	CS, CEAS, FD, INS
CEA shroud tube	CS, CEAS, FD, INS
Core Shroud Assembly	
Core shroud plates Plates Ribs Intermediate plates Core shroud guide lugs	CS, CEAS, FD, INS
Core Support Barrel (CSB) Assembly	
CSB alignment keys	CS, CEAS, INS

Table 2.3.1-2 (Continued)	
Component Type	**Intended Function**
CSB assembly dowel pin CSB lifting bolt insert CSB lower flange CSB lug CSB nozzle	CS, CEAS, FD, INS
CSB cylinder CSB upper flange	CS, CEAS, FD, INS
CSB cylinder CSB upper flange (continued)	CS, CEAS, FD, INS
Incore Instrumentation (ICI)	
Guide tubes ICI thimble support plate assembly ICI support plate, grid, lifting support, lifting plate, column, plates, funnel Pad, ring, nipple, hex bolt, spacer Threaded rod, hex jam nut, thimble support nut, cap screws	FD, INS
Lower Internals Assembly	
Bottom plate Bottom plate manhole cover Cylinder	CS, CEAS, FD, INS

Table 2.3.1-2 (Continued)	
Component Type	**Intended Function**
Core support column Core support plate Insert pins Support beam Support beam flange	CS, CEAS, FD, INS
Upper Internals Assembly	
Fuel assembly alignment plate (FAP) FAP guide lug inserts	CS, CEAS, FD, INS
Holddown ring	CS, FD, INS
Upper guide structure (UGS) support plate UGS cylinder UGS grid plate UGS flange UGS sleeve UGS lifting bolt insert UGS alignment keys UGS dowel pins	CS, CEAS, FD, INS

Table 2.3.1-3
Class 1 Piping, Valves, and Reactor Coolant Pumps
Components Subject to Aging Management Review

Table 2.3.1-3	
Component Type	**Intended Function**
Charging inlet nozzle Safety injection nozzle Surge line nozzle	Pressure boundary
Charging inlet nozzle safe end Drain nozzle safe ends Letdown nozzle safe ends Pressure measurement nozzle safe end Sampling nozzle safe end	Pressure boundary
Charging inlet nozzle thermal sleeve Safety injection nozzle thermal sleeve Surge line thermal sleeve	Pressure boundary
Class 1 boundary orifices	Pressure boundary Flow control
Class 1 pipe and fittings NPS less than 4”	Pressure boundary
Class 1 pipe 4” $\geq$ NPS	Pressure boundary
Class 1 fittings	Pressure boundary
Cold leg piping and elbows Hot leg pipe and elbows	Pressure boundary

Table 2.3.1-3 (Continued)	
Component Type	**Intended Function**
Drain nozzles Letdown nozzles Shutdown cooling outlet nozzle Spray nozzle	Pressure boundary
Pressure measurement nozzle Replacement pressure nozzle Sampling nozzle	Pressure boundary
RCP safe ends	Pressure boundary
RTD nozzles	Pressure boundary
Safety injection nozzle safe end Shutdown cooling outlet nozzle safe end Surge nozzle safe end	Pressure boundary
Stainless steel bolting	Pressure boundary
Surge line pipe and elbows	Pressure boundary
Surge line piping: - RTD nozzles - Sampling nozzles	Pressure boundary
Class 1 Valves	
Carbon / alloy steel bolting	Pressure boundary
Valve bodies and bonnets	Pressure boundary
Class 2 and 3 Piping and Valves	
Class 2 and 3 closure bolting	Pressure boundary

Table 2.3.1-3 (Continued)	
Component Type	**Intended Function**
Class 2 and 3 fittings	Pressure boundary
Class 2 and 3 pipe	Pressure boundary
Class 2 and 3 valve bodies and bonnets	Pressure boundary
Tubing	Pressure boundary
Reactor Coolant Pump (RCP)	
RCP casing	Pressure boundary
RCP cover	Pressure boundary
RCP cover studs RCP cover nuts	Pressure boundary
RCP driver mount assembly	Pressure boundary
RCP thermal barrier heat exchanger inner coil	Pressure boundary
RCP thermal barrier heat exchanger outer coil RCP thermal barrier bored hole heat exchanger	Pressure boundary

Table 2.3.1-4
Pressurizer
Components Subject to Aging Management Review

Table 2.3.1-4	
Component Type	**Intended Function**
Heater end plug Heater sheaths Heater sleeves	Pressure boundary
Heater support channel	SSR
Heater support plates Heater support plate brackets	SSR
Heater support plate bracket bolts	SSR
Lower head Lower shell Upper shell Upper head	Pressure boundary
Lower level nozzle	Pressure boundary
Manway cover bolts/studs	Pressure boundary
Manway cover plate	Pressure boundary
Manway forging	Pressure boundary
Manway gasket retainer plate	Pressure boundary
MNSA bolting (studs, nuts, and washers)	Pressure boundary
MNSA compression collar MNSA upper flanges	Pressure boundary

Table 2.3.1-4 (Continued)	
Component Type	**Intended Function**
Pressure measurement nozzle Upper level nozzle Vent nozzle Temperature nozzle	Pressure boundary
Pressure measurement nozzle safe end Upper/lower level nozzle safe end Temperature nozzle safe end Vent nozzle safe end	Pressure boundary
Safety valve nozzle Spray nozzle Surge nozzle	Pressure boundary
Safety valve nozzle flange	Pressure boundary
Spray nozzle safe end	Pressure boundary
Spray nozzle thermal sleeve Surge nozzle thermal sleeve	Pressure boundary
Support skirt	SSR
Surge nozzle safe end	Pressure boundary

Table 2.3.1-5
Steam Generator
Components Subject to Aging Management Review

Table 2.3.1-5	
Component Type	**Intended Function**
Primary Side	
Channel head Primary inlet nozzle Primary nozzle safe ends Primary outlet nozzle	Pressure boundary
Channel head divider plate	Pressure boundary
Primary bolting: Studs, closure nuts and washers, and screws	Pressure boundary
Primary manway cover	Pressure boundary
Primary manway insert plate	Pressure boundary
Primary nozzle closure rings	Pressure boundary
Tube plate	Pressure boundary
Tube plugs	Pressure boundary
U-tubes	Pressure boundary Heat transfer
Secondary Side	
3” Inspection port cover	Pressure boundary
3” Inspection port diaphragms	Pressure boundary
6” Inspection port cover 8” Hand hole cover	Pressure boundary

Table 2.3.1-5 (Continued)	
Component Type	**Intended Function**
Anti-vibration bars Tube support plates	SSR
Anti-vibration bar end caps Peripheral retaining rings U-bend U-shaped retainer bars	SSR
Blowdown and sampling nozzles Narrow and wide range water level taps	Pressure boundary
Elliptical head Transition cone Upper and lower shell barrels	Pressure boundary
Feedwater inlet nozzles	Pressure boundary
Feedwater thermal sleeve	Pressure boundary
Flow limiting insert (integral flow restrictors (venturis))	Pressure boundary, Flow control
Key bracket Snubber lug	SSR
Secondary bolting: studs, closure washers and nuts	Pressure boundary
Secondary manway cover	Pressure boundary
Steam outlet nozzle	Pressure boundary

Table 2.3.1-5 (Continued)	
Component Type	**Intended Function**
Tube bundle support system: -stay rods -stay rod hex nuts -spacer pipes -peripheral backup bars	SSR
Wrapper Wrapper jacking screws	Heat transfer

2.3.2 Engineered Safety Features

The engineered safety features are described in SAR Chapter 6. The following systems are included in this section.

- emergency core cooling
- containment spray system
- containment cooling
- containment penetrations
- hydrogen control

2.3.2.1 Emergency Core Cooling

System Description

The purpose of the emergency core cooling system (ECCS) is to provide core cooling and core reactivity control under accident conditions including a loss of coolant accident (LOCA) or a main steam line break. Following a LOCA, the cooling must prevent fuel melting or significant alteration of core geometry, limit the cladding metal-water reaction, and remove the energy generated in the core for an extended period of time. In the unlikely event of a main steam line break, the ECCS injects borated water into the reactor coolant system to prevent fuel damage and to increase the shutdown margin of the core.

The major ECCS subsystems are high pressure safety injection (HPSI), low pressure safety injection (LPSI), and the safety injection tanks. The LPSI system consists of two pumps that discharge into a combined low pressure header that has a return connection from the shutdown cooling heat exchangers. The HPSI system has three electric motor-driven pumps installed in parallel. Two high pressure injection headers and eight motor-operated injection valves connect the pumps to the four injection points on the RCS loop cold legs. The LPSI and HPSI pumps are designed to initially take suction from the refueling water tank (RWT) and inject water into the RCS to provide core cooling. The safety injection tanks, containing borated water pressurized with nitrogen, are connected to the RCS by injection piping and valves.

The Class 1 components of the ECCS are evaluated with the RCS in Section 2.3.1. Certain components classified with the HPSI system are part of the CVCS charging lines at the interface with the injection headers and are evaluated in Section 2.3.3.5. The LPSI system contains nonsafety-related components whose failure could impact safety-related components and the ECCS is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(2); these components are evaluated in Section 2.3.3.11.

The ECCS evaluation includes the CVCS valve in the supply from the refueling water tank and primary sampling system components associated with ECCS.

The LPSI pumps, shutdown cooling (SDC) heat exchangers and associated equipment in the flow path are credited with RCS decay heat removal for safe shutdown after a fire. The “B” HPSI pump and injection valves in the HPSI system are credited with reactor coolant inventory maintenance for safe shutdown after a fire. These components perform functions that demonstrate compliance with the Commission’s regulations for fire protection (10CFR50.48).

The emergency core cooling system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Section 6.3 discusses the emergency core cooling system.

Components Subject to Aging Management Review

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

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

License Renewal Drawings

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

LRA-M-2232 Sh. 1
LRA-M-2236 Sh. 1
LRA-M-2237 Sh. 1
LRA-M-2210 Sh. 2
LRA-M-2231 Sh. 1
LRA-M-2230 Sh. 1

2.3.2.2 Containment Spray System

System Description

The purpose of the containment spray system is to provide spray cooling water to the containment atmosphere following a LOCA or main steam line break inside containment. This cooling water limits the peak pressure in containment to below containment design pressure. A secondary function of the containment spray system is removal of radioactive iodine from the containment atmosphere during a LOCA.

The containment spray system consists of two independent flow trains. Each train includes a pump, heat exchanger, sets of spray nozzles and ring headers, with associated piping, valves and instrumentation necessary for operation. The RWT provides the source of borated water to the containment spray system during the injection phase of an accident. Once the RWT is exhausted, the containment spray system takes suction from the water accumulated in the containment recirculation sump.

The RWT, which is included in the containment spray system boundary, provides a source of borated water for the emergency core cooling system and the containment spray system during post-accident operations. The containment sump header mechanical components are reviewed with the containment spray system. The shutdown cooling heat exchangers are included in this system since they cool the spray water under accident conditions.

This system contains nonsafety-related components whose failure could impact safety-related components; these components are evaluated in Section 2.3.3.11.

Portions of the containment spray system such as the RWT and the portions required for shutdown cooling operation are required for compliance with the Commission's regulations for fire protection (10CFR50.48).

The containment spray system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Section 6.2.2 discusses the containment spray system.

Components Subject to AMR

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

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

License Renewal Drawings

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

LRA-M-2210 Sh. 2
LRA-M-2231 Sh. 1
LRA-M-2235 Sh. 1
LRA-M-2236 Sh. 1
LRA-M-2232 Sh. 1

2.3.2.3 Containment Cooling

System Description

The containment cooling system (CCS) provides cooling and air circulation inside containment. The purpose of the CCS is to reduce the containment pressure and temperature after a postulated LOCA or main steam line break by removing thermal energy from the containment atmosphere. This will also reduce off-site radiation levels by reducing the pressure differential between the containment atmosphere and the outside atmosphere, thereby reducing the driving force for leakage of fission products from containment.

The CCS is an AMR system (see Section 2.2) that includes system codes reactor building heating and ventilation (RBHV) and reactor building purge air (PA). The hydrogen recombiners are evaluated with the hydrogen control system in Section 2.3.2.5.

The purpose of the RBHV system is to provide cooling and heating to containment during power operation, plant shutdown, and accident conditions. The RBHV system consists of the containment cooling units (including fans, chilled water cooling coils and service water cooling coils), the containment recirculation fans (which are evaluated with the hydrogen control system in Section 2.3.2.5), nonsafety-related CEDM shroud cooling units, and nonsafety-related reactor cavity cooling fans. The RBHV system contains safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). This system contains nonsafety-related components whose failure could impact safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(2); these components are evaluated in Section 2.3.3.11.

The purpose of the reactor building purge air (PA) system is to provide outside air to purge the containment building during plant shutdown for personnel access. The PA system consists of fans, filters and associated piping and valves. The system has the safety function of containment isolation for the purge penetration and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(1).

The CCS is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1) and 10CFR54.4(a)(2).

SAR References

Section 9.4.5.2 discusses the containment cooling system. Section 6.2.2 discusses containment heat removal under accident conditions.

Components Subject to AMR

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

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

License Renewal Drawings

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

LRA-M-2210 Sh. 3

LRA-M-2261 Sh. 1

2.3.2.4 Containment Penetrations

System Description

The purpose of the containment penetrations system is to provide the means of isolating fluid systems that pass through containment penetrations so as to confine to the containment radioactivity that may be released following an accident. For license renewal, the containment penetrations system is the passive mechanical penetration components that are not included in another system aging management review. In general, if a system has its own system-level aging management review, then the associated containment penetrations are reviewed with that system and not in this section.

This grouping of containment isolation components from various plant systems into one consolidated review is appropriate as indicated in NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* Section 2.1.3.1, which states, "An applicant may take an approach in scoping and screening that combines similar components from various systems. For example, containment isolation valves from the various systems may be identified as a single system for the purpose of license renewal." Section V.C of NUREG-1801, "Containment Isolation Components," recognizes the grouping: "The system consists of isolation barriers in lines for BWR and PWR non-safety systems such as the plant heating, waste gas, plant drain, liquid waste, and cooling water systems."

Containment penetrations are designed to provide at least a double barrier to the escape of radioactive material at each fluid penetration through the containment liner plate. Double barriers are provided to ensure that no single, credible failure or malfunction of an active or passive system component can result in loss of isolation or significant leakage.

The electrical penetration nitrogen pressurization system provides continuous pressurization of the electrical penetrations with ultra-high purity nitrogen. The system consists of two sets of three seismically mounted nitrogen bottles, isolation valves, pressure relief valves, tubing, and instrumentation.

Components in the steam generator sample and blowdown penetrations are required for safe shutdown following a fire (10CFR50.48).

The containment penetrations system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1) and 10CFR54.4(a)(3).

SAR References

Section 6.2.4 and Table 6.2-26 discuss the containment mechanical penetrations.

Components Subject to AMR

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

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

License Renewal Drawings

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

LRA-M-2206 Sh. 1	LRA-M-2218 Sh. 1	LRA-M-2222 Sh. 1
LRA-M-2206 Sh. 2	LRA-M-2218 Sh. 2	LRA-M-2234 Sh. 1
LRA-M-2213 Sh. 1	LRA-M-2218 Sh. 3	LRA-M-2237 Sh. 1
LRA-M-2213 Sh. 8	LRA-M-2218 Sh. 5	LRA-M-2239 Sh. 1
LRA-M-2214 Sh. 1	LRA-M-2218 Sh. 6	LRA-M-2239 Sh. 2
LRA-M-2215 Sh. 1	LRA-M-2220 Sh. 1	

2.3.2.5 Hydrogen Control

System Description

The purpose of the hydrogen control system is to limit the hydrogen gas concentration inside containment following a LOCA. To assure that containment integrity is maintained, the hydrogen control system has the following safety functions:

(a) removing hydrogen gas from the containment building atmosphere after a LOCA to maintain the concentration of gases below the limits of flammability, and

(b) providing a direct reading of the concentration of hydrogen gas concentration in the containment building.

The hydrogen control system is an AMR system (see Section 2.2) which includes components from system codes hydrogen purge (HPA), hydrogen recombiners (HR), reactor building ventilation (RBHV), and radiation monitoring system (RMS). As described in the SAR, these systems are the containment atmosphere monitoring system, the hydrogen recombiner system, and the containment air recirculation system.

ANO-2 was originally designed with a hydrogen purge system that was intended to release the post-accident containment atmosphere and reduce the hydrogen concentration by adding air to containment. Since hydrogen recombiners are now used, a number of components are spared in place. The hydrogen purge system includes valves that were originally intended to supply service water under accident conditions to the purge components but now only have the safety function of maintaining the service water pressure boundary. These valves are evaluated with the service water system in Section 2.3.3.8.

The hydrogen recombiners are evaluated as an electrical system (see Table 2.2-1b).

The hydrogen control system is within the scope of license renewal based on the criterion of 10CFR54.4(a)(1).

SAR References

Section 6.2.5 discusses the hydrogen control system.

Components Subject to AMR

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

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

The containment air recirculation system is not credited in any design basis accident or transient analysis for accomplishing hydrogen mixing. Therefore, the components within the containment air recirculation system (system code RBHV) are not subject to aging management review.

The radiation monitors (system code RMS) associated with the containment atmosphere monitoring system do not perform an intended function and are therefore not subject to aging management review.

License Renewal Drawings

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

LRA-M-2261 Sh. 1
LRA-M-2261 Sh. 3
LRA-M-2261 Sh. 4

Table 2.3.2-1
Emergency Core Cooling System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bearing housing	Heat transfer Pressure boundary
Bolting	Pressure boundary
Heat exchanger (shell)*	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Nozzle	Pressure boundary
Orifice	Pressure boundary Flow control
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet and tube sheet for this system.

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

Component Type	Intended Function(s)
Bolting	Pressure boundary
Filter housing	Filtration Pressure boundary
Heat exchanger (shell)*	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heat exchanger (tubesheet)	Pressure boundary
Heater housing	Pressure boundary
Nozzle	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary
Vortex breaker	Vortex elimination

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet for this system.

Table 2.3.2-3
Containment Cooling System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blower housing	Pressure boundary
Bolting	Pressure boundary
Cooling coil assembly	Heat transfer Pressure boundary
Cooling coil housing	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Piping	Pressure boundary
Valve	Pressure boundary

Table 2.3.2-4
Containment Penetrations System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Flex hose	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.2-5
Hydrogen Control System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

2.3.3 Auxiliary Systems

The following systems are included in this section:

- spent fuel pool
- water suppression fire protection
- emergency diesel generator
- alternate ac diesel generator
- chemical and volume control
- halon fire protection and reactor coolant pump motor oil leakage collection
- fuel oil
- service water
- auxiliary building ventilation
- control room ventilation
- miscellaneous systems in scope for 10CFR54.4(a)(2)
- other miscellaneous systems

2.3.3.1 Spent Fuel Pool

System Description

The subsystems that make up the spent fuel pool system are fuel pool cooling and purification, spent fuel pool, and fuel handling.

The purpose of the fuel pool cooling and purification subsystem is to remove decay heat from the stored spent fuel and maintain purity and optical clarity of the water in the spent fuel pool, the fuel transfer canal and the refueling canal. The subsystem consists mainly of nonsafety-related fuel pool pumps, heat exchanger, filters, demineralizer, and associated piping and valves. The subsystem contains nonsafety-related components whose failure could impact safety-related components and the system is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(2); these components are evaluated in Section 2.3.3.11. The safety-related components evaluated with this subsystem include components associated with containment penetrations, a CVCS valve in the makeup to the spent fuel pool system, and components associated with the service water supply to the spent fuel pool. If system cooling is lost, the seismic Class 1 service water system can provide water directly to the spent fuel pool to maintain level, which will boil off to cool the spent fuel assemblies. The spent fuel pool cooling system piping and valves that supply service water to the spent fuel pool from the #1 service water loop are safety-related. The redundant feed from the #2 service water loop feeds directly to the spent fuel pool and does not route through spent fuel pool cooling components.

The purpose of the spent fuel pool subsystem is to store new and spent fuel in a subcritical condition. Included in this subsystem are the spent fuel racks and the new fuel racks. The new and spent fuel pool racks are safety-related and are required to support the fuel assemblies. The new fuel racks are evaluated as a structural component in Section 2.4.2.

The purpose of the fuel handling subsystem is to provide the capability of (1) underwater handling and transfer of spent fuel and control components removed from the reactor to the spent fuel pool, (2) movement of fuel and control components within the reactor vessel, and (3) movement of new fuel from the spent fuel pool to the reactor. The subsystem also provides the capability to move new fuel from shipping containers to new fuel storage or spent fuel storage.

The fuel handling subsystem consists of fuel handling equipment such as the fuel transfer tube, the spent fuel pool crane, upender assemblies, refueling machine, spent fuel machine, the new fuel elevator, and manual tools. The fuel transfer tube is a containment penetration and is therefore safety-related. Some of the fuel handling cranes are seismic Class 1 in the parked position. The cranes are evaluated in Section 2.4.1 and 2.4.2. The safety-related fuel transfer tube gasket air test isolation valve is a service air system component which is evaluated with the spent fuel pool system.

The spent fuel pool system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1) and 10CFR54.4(a)(2).

<u>SAR References</u>

Section 9.1 discusses the spent fuel pool system.

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

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

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

License Renewal Drawings

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

LRA-M-2235 Sh. 1

2.3.3.2 Water Suppression Fire Protection

System Description

The purpose of the water suppression fire protection system (WSFPS) is to minimize the effects of fires on plant structures, systems, and components important to safety to the extent that a fire will not compromise the ability to achieve safe shutdown of the plant.

The WSFPS consists of (1) fire water pumps and drivers, (2) the fire water distribution system, including the outside loop, hydrants, hose stations, standpipes, sectional control valves and isolation valves, and (3) deluge and pre-action systems, including piping, control valves and sprinkler heads. Safety-related components at the containment penetration are included in this system. This system performs a function that demonstrates compliance with the Commission's regulations for fire protection (10CFR50.48).

The WSFPS includes components shared with ANO-1, such as the fire pumps. To have a complete review of the components required for ANO-2 operation, the components necessary for providing protection to the systems required for ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal.

The ventilation components required to cool the fire water pumps (in the ANO-1 intake structure) are classified with the ANO-1 intake structure system but have been reviewed with the ANO-2 WSFPS to ensure supporting equipment is reviewed as required.

The WSFPS provides containment isolation for a containment penetration. This is the only portion of the system that directly performs a safety function (containment isolation).

The water suppression fire protection system contains nonsafety-related components whose failure could impact safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(2); these components are evaluated in Section 2.3.3.11. Fuel oil components associated with the diesel-driven fire pump are evaluated with the fuel oil system in Section 2.3.3.7.

The water suppression fire protection system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Section 9.5.1 discusses the fire protection system.

Components Subject to Aging Management Review

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

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

License Renewal Drawings

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

LRA-M-219 Sh. 1
LRA-M-260 Sh. 3
LRA-M-2219 Sh. 1
LRA-M-2219 Sh. 2
LRA-M-2219 Sh. 5
LRA-M-2219 Sh. 5A

2.3.3.3 Emergency Diesel Generator

System Description

The purpose of the emergency diesel generator system (EDG) is to provide redundant emergency power sources capable of furnishing adequate power to safely shutdown the reactor, remove reactor residual heat, and maintain the unit in a safe shutdown condition upon the loss of preferred power with or without a coincident design basis event. The EDGs are the redundant emergency power sources. The EDG system consists of diesel generators and the following subsystems: starting air, cooling water, lubrication, and combustion air intake and exhaust. The fuel oil storage and transfer subsystem associated with the EDG is evaluated in Section 2.3.3.7.

The system is the safety-related source of electrical power required for engineered safety features loads during design basis events. The system also provides emergency power required for safe shutdown following a fire. The EDG system is therefore within the scope of license renewal based on the criteria of 10CFR54.4(a)(1) and 10CFR54.4(a)(3).

SAR References

Section 8.3.1.1.7 discusses the emergency diesel generator system. Sections 9.5.5 through 9.5.9 discuss the diesel generator subsystems.

Components Subject to Aging Management Review

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

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

License Renewal Drawings

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

LRA-M-2217 Sh. 1
LRA-M-2217 Sh. 2
LRA-M-2217 Sh. 3

2.3.3.4 Alternate AC Diesel Generator

System Description

The purpose of the alternate AC (AAC) diesel generator system is to provide backup power at ANO. The AAC generator is a 4400 KW diesel generator installed in response to the regulatory requirements of 10CFR50.63, "Loss of All Alternating Current Power." The AAC system consists of a single diesel generator and the following subsystems: air start, engine cooling water, lubrication, combustion air intake and exhaust, fuel oil, and AAC building heating and ventilation (ventilation components are part of the ventilation system code (VENT)).

The AAC generator system is required by 10CFR50.63, but it does not have a safety function. The system is nonsafety related. The AAC generator system is credited for providing power during a loss of off-site power concurrent with a loss of the EDGs (i.e., station blackout). The AAC diesel is capable of furnishing adequate power to safely shutdown the reactor upon loss of all AC power on Unit 2 by connecting to either of the 4160V safety-related buses on the unit.

The AAC diesel is also credited with operation for safe shutdown after a fire for electrical power.

Therefore the AAC system is within the scope of license renewal based on the criterion of 10CFR54.4(a)(3) for the fire protection and station blackout regulated events.

The AAC generator is shared with ANO-1. To have a complete review of the components required for ANO-2 operation, portions of the system that are required to support the supply of power to ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal.

SAR References

Section 8.3.3 discusses the alternate AC diesel generator system.

Components Subject to Aging Management Review

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

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

License Renewal Drawings

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

LRA-M-2241 Sh. 1
LRA-M-2241 Sh. 2
LRA-M-2241 Sh. 4
LRA-M-2241 Sh. 5
LRA-M-2260 Sh. 4

2.3.3.5 Chemical and Volume Control

System Description

The purpose of the chemical and volume control system (CVCS) is to maintain reactor coolant system (RCS) inventory and control RCS chemistry. The CVCS system consists of four subsections: letdown, charging, boron addition and reactor makeup water. The CVCS also supplies borated water to the RCS from the boric acid makeup tanks or the refueling water tank via the charging pumps.

The components in this system are mostly nonsafety-related, but there are safety-related components that are containment isolation valves, part of the RCS pressure boundary, or boundary valves to safety-related systems.

The CVCS contains nonsafety-related components whose failure could impact safety-related components. These components are evaluated in Section 2.3.3.11.

This system is credited as one method of providing RCS inventory addition for safe shutdown following a fire with the suction supplied from the refueling water tank or the boric acid makeup tanks. These components perform a function that demonstrates compliance with the Commission's regulations for fire protection (10CFR50.48).

The portions of the CVCS that are part of the reactor coolant system pressure boundary are evaluated with the reactor coolant system in Section 2.3.1. The CVCS valve in the supply from the refueling water tank is evaluated with the ECCS in Section 2.3.2.1. The CVCS valves in the makeup to the spent fuel pool system are evaluated with the spent fuel pool system in Section 2.3.3.1.

The CVCS evaluation includes components from the nitrogen supply system that are associated with the charging pump pulsation dampeners and suction stabilizers.

The CVCS is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Section 9.3.4 discusses the chemical and volume control system.

Components Subject to Aging Management Review

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

Table 3.3.2-5 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-2230 Sh. 2
LRA-M-2231 Sh. 1
LRA-M-2231 Sh. 2

2.3.3.6 Halon Fire Protection and Reactor Coolant Pump Motor Oil Leakage Collection

System Description

The purpose of the halon system is to provide fire suppression in the core protection calculator (CPC) room. The system is activated automatically or manually and will flood the CPC room with Halon 1301 to extinguish the fire. The Halon system consists of Halon storage tanks, discharge piping, valves, controls, alarms, smoke detectors, etc.

The system does not contain safety-related components, but it does contain components required for fire protection.

The reactor coolant pump motor oil leakage collection system (RCPMOLCS) is designed to collect random leakage from the four RCP motors in order to reduce the chance of a fire. Each of the sump tanks has the capacity to contain the lube oil inventory of a single RCP.

The Halon system and the RCPMOLCS are required for compliance with the Commission's regulations for fire protection (10CFR50.48) and are therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(3).

<u>SAR References</u>

Sections 9.5.1.2 and 9.5.1.3 discuss the Halon system and reactor coolant pump motor oil leakage collection system.

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

Table 2.3.3-6 lists the component types that require aging management review.

Table 3.3.2-6 provides the results of the aging management review.

<u>License Renewal Drawings</u>

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

LRA-M-2219 Sh. 6
LRA-M-2233 Sh. 1

2.3.3.7 Fuel Oil

<u>System Description</u>

The purpose of the fuel oil system is to provide fuel oil for site components, including the various diesel engines and the auxiliary boiler. The system consists of various tanks, pumps, injectors, piping, and valves to store and transfer fuel oil.

The system contains components that are the safety-related source of diesel fuel as required for emergency diesel operation during design basis events. The system provides diesel fuel as required to the AAC generator for the SBO event. The fuel oil to the fire diesel, the emergency generators, and AAC generators is credited for the safe shutdown fire regulated event.

The fuel oil system includes ANO-1 shared components such as the bulk fuel oil storage tank. To have a complete review of components required for ANO-2 operation, components necessary for providing fuel oil to the systems required for ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal. The ANO-1 fuel oil system is credited as a backup supply to the ANO-2 diesel generators in the case of a fire that renders the ANO-2 fuel oil transfer pumps unavailable.

The fuel oil system includes safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The fuel oil system is required for compliance with the Commission's regulations for fire protection (10CFR50.48) and SBO events and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(3).

SAR References

Sections 8.3.3.2.3.3, 9.5.1, and 9.5.4 discuss the fuel oil system.

Components Subject to Aging Management Review

Table 2.3.3-7 lists the component types that require aging management review.

Table 3.3.2-7 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-217 Sh. 1
LRA-M-219 Sh. 1
LRA-M-220 Sh. 2
LRA-M-2217 Sh. 1
LRA-M-2220 Sh. 1
LRA-M-2241 Sh. 3

2.3.3.8 Service Water

System Description

The purpose of the service water (SW) system is to provide cooling water from Lake Dardanelle or the emergency cooling pond to safety-related and nonsafety-related equipment and to provide an emergency supply of water to the emergency feedwater system and the fuel pool system. The SW system provides cooling water to two independent flow paths, which furnish water to two independent, safety-related engineered safety features (ESF) equipment trains and two nonsafety-related flow paths (auxiliary cooling water and component cooling water heat exchangers/main chillers). Three service water pumps are provided to supply the various components cooled by service water.

The SW system is the safety-related source of cooling water for equipment cooling during design basis events. The system contains nonsafety-related components whose failure could impact safety-related components; these components are evaluated in Section 2.3.3.11. The SW system is required to function following a fire for safe shutdown of the unit.

The EFW suction supply valves from the SW system are evaluated with the SW system. The service water evaluation also includes hydrogen control system valves that were originally intended to supply service water under accident conditions to the purge components but now only have the safety function of maintaining the service water pressure boundary. Ventilation components that provide cooling for the SW pumps and motors are classified as part of the intake structure system but are evaluated with the service water system. The individual service water supplied heat exchangers are evaluated with the systems that they cool.

The service water system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Sections 9.2.1, 9.2.5, 3.6.4.5.1.1, and 9.4.6 discuss the service water system.

Components Subject to Aging Management Review

Table 2.3.3-8 lists the component types that require aging management review.

Table 3.3.2-8 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-2204 Sh. 4	LRA-M-2221 Sh. 2
LRA-M-2210 Sh. 1	LRA-M-2235 Sh. 1
LRA-M-2210 Sh. 2	LRA-M-2260 Sh. 1
LRA-M-2210 Sh. 3	LRA-M-2261 Sh. 2
LRA-M-2217 Sh. 3	LRA-M-2261 Sh. 3

2.3.3.9 Auxiliary Building Ventilation

System Description

The purpose of the auxiliary building ventilation system is to provide ventilation for equipment in the auxiliary building and the auxiliary building extension. The system consists of safety-related and nonsafety-related equipment in the auxiliary building to provide both normal and emergency cooling and ventilation. The system includes the auxiliary building heating and ventilation (ABHV) system code.

The auxiliary building is served by separate ventilation systems for each of the following areas.

- fuel handling floor radwaste area
- auxiliary building radwaste area (includes electrical equipment room 2096)
- non-contaminated areas
- emergency diesel generator rooms
- battery rooms and DC equipment rooms
- switchgear rooms
- cable spreading room and electrical equipment room 2108
- computer room 2098-C
- electrical MG room 2076
- ventilation equipment room
- main steam line enclosure
- elevator-machine room
- boiler room area
- heat exchanger and pipeway area
- electrical equipment room 2091

The components within these subsystems include supply and exhaust fans, cooling and heating coils, dampers, filters, ductwork, condensing units, and dehumidifiers.

Safety-related ventilation systems serve areas containing safety-related equipment, including the HPSI pumps, the charging pumps, the shutdown cooling heat exchangers, the emergency feedwater pumps, electrical equipment (rooms 2091 and 2096), the emergency diesel generators, batteries, and switchgear.

This system contains nonsafety-related components whose failure could impact safety-related components. These components are evaluated in Section 2.3.3.11.

The cooling for some components, such as the emergency diesel generator room and the safety parameters display system (SPDS) room, is required to support safe shutdown following a fire. The fire dampers included in this system are required for fire protection (10CFR50.48).

Components in the ABHV system code that support control room ventilation are evaluated with control room ventilation in Section 2.3.3.10.

The system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Section 9.4.2 discusses the auxiliary building ventilation system.

Components Subject to Aging Management Review

Table 2.3.3-9 lists the component types that require aging management review.

Table 3.3.2-9 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-2262 Sh. 1
LRA-M-2262 Sh. 2
LRA-M-2263 Sh. 5
LRA-M-2263 Sh. 6
LRA-M-2210 Sh. 2
LRA-M-2210 Sh. 3

2.3.3.10 Control Room Ventilation

System Description

The purpose of the control room ventilation (CRV) system is to provide a suitable environment for equipment and personnel in the control room. The system contains normal and emergency operation trains that include ductwork, filter units, blowers, cooling units and heat exchangers to supply the control room space with the proper heating or cooling and limit the post-accident dose rate to the operators.

The CRV system is the safety-related source of ventilation as required for control room cooling during design basis events and provides protection from emergency events such as a toxic gas release. The system contains fire dampers that must close to isolate the control room in the event of a fire. These dampers are required for compliance with the Commission's regulations for fire protection (10CFR50.48).

This system is shared with ANO-1. To have a complete review of the components required for ANO-2 operation, the components necessary for providing cooling for ANO-2 are evaluated even if they have already been reviewed for ANO-1 license renewal.

Safety-related components of the chilled water system that support control room ventilation are included in this evaluation.

The CRV system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1) and 10CFR54.4(a)(3).

SAR References

Section 9.4.1 discusses the control room ventilation system.

Components Subject to Aging Management Review

Table 2.3.3-10 lists the component types that require aging management review.

Table 3.3.2-10 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-2210 Sh. 1
LRA-M-2221 Sh. 2
LRA-M-2262 Sh. 1
LRA-M-2263 Sh. 1

2.3.3.11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2)

System Description

Systems within the scope of license renewal based on the criterion of 10CFR54.4(a)(2) were identified using the method described in Section 2.1.1.2. A review of each mechanical system was performed to identify nonsafety-related systems or nonsafety-related portions of safety-related systems with the potential for adverse spatial interaction with safety-related systems or components. Components subject to aging management review due to the scoping criterion of 10CFR54.4(a)(2) are evaluated in this section.

Systems within the scope of license renewal based on the criterion of 10CFR54.4(a)(2) may also meet the criteria of 10CFR54.4(a)(1) or 10CFR54.4(a)(2). The system description discusses which scoping criteria are met.

The following systems are within the scope of license renewal based on the criterion of 10CFR54.4(a)(2) and are described in the referenced sections.

auxiliary building ventilation (Section 2.3.3.9)

containment spray (Section 2.3.2.2)

chemical and volume control (Section 2.3.3.5)

containment cooling (reactor building ventilation) (Section 2.3.2.3)

emergency feedwater (EFW and condensate storage and transfer) (Section 2.3.4.3)

spent fuel pool (fuel pool cooling and purification) (Section 2.3.3.1)

main feedwater (Section 2.3.4.2)

emergency core cooling (low pressure safety injection) (Section 2.3.2.1)

main steam (Section 2.3.4.1)

reactor coolant (RCS and reactor coolant pump system) (Section 2.3.1)

service water (Section 2.3.3.8)

water suppression fire protection (Section 2.3.3.2)

The following systems are within the scope of license renewal based on the criterion of 10CFR54.4(a)(2) and have not been described elsewhere in the application. Where additional scoping criteria apply, this is noted in the descriptions below with a reference to the section where the affected components are evaluated.

auxiliary building sump	post-accident sampling system
auxiliary cooling water	plant heating
auxiliary steam	primary sampling
boron management	regenerative waste
chemical addition	resin transfer
chilled water	sampling system
circulating water	shutdown cooling
component cooling water	spent resin
domestic water	startup and blowdown demineralizers
drain collection header	steam generator secondary / blowdown
liquid radwaste management	turbine building sump

Auxiliary Building Sump

The purpose of the auxiliary building sump (ABS) system is to provide drainage for equipment to support normal plant operation. The system contains piping, valves and pumps for equipment and floor drains in the containment, auxiliary building, and turbine building.

The safety-related components at the containment penetration are evaluated with the containment penetrations in Section 2.3.2.4. Therefore the ABS system is also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1).

Auxiliary Cooling Water

The purpose of the auxiliary cooling water (ACW) system is to provide cooling water to nonsafety-related components in the auxiliary building and turbine building to support normal plant operation. The water supply to the auxiliary cooling water system is from the service water system pumps. Service water system valves provide isolation of the SW system from ACW as necessary under accident conditions.

Auxiliary Steam

The purpose of the auxiliary steam system is to provide low pressure steam for heating and process purposes to support normal plant operation and system testing. The system contains valves, orifices, piping, and tubing.

Boron Management

The purpose of the boron management system (BMS) is to provide collection, handling and treatment of borated water to assist in the control of the boron concentration of the primary systems. The major influent to the BMS is reactor coolant from the chemical and volume control system letdown due to feed and bleed operations for shutdown, startup, and boron dilution over core life. The boron management system consists of boric acid tanks, holdup tanks, pumps and various piping and valves. The system also contains boric acid evaporators and concentrators, but these are no longer utilized.

The system contains safety-related components and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). These safety-related components are evaluated with the containment penetration system (Section 2.3.2.4).

Chemical Addition

The purpose of the chemical addition system is to provide chemicals for various water systems. The majority of this system is not safety-related and only supports proper water chemistry controls for normal plant operation. The system includes chemical storage tanks, pumps, valves and miscellaneous components needed to store and inject chemicals. The system includes the safety-related trisodium phosphate dodecahydrate (TSP-C) baskets in the containment and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The TSP-C baskets in the containment are evaluated as a structural bulk commodity in Section 2.4.4.

Chilled Water

The purpose of the chilled water system is to provide chilled water to cooling units. This system includes components of several closed-loop chilled water systems in different areas of the plant including the containment, auxiliary building and turbine building. Many of the system components are nonsafety-related, are not required for emergency cooling or regulated events and only provide cooling to support normal plant operation.

The system contains safety-related components and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). These components are included with other system evaluations: the containment penetration components are evaluated in Section 2.3.2.4 and components in control room ventilation are evaluated in Section 2.3.3.10.

Circulating Water

The purpose of the circulating water system is to provide cooling water to the main condenser. One section of pipe and a valve require aging management review based on the criterion of 10CFR54.4(a)(2). These components, located in the auxiliary building, are used to drain the circulating water system to the service water discharge pipe.

Component Cooling Water

The purpose of the component cooling water system is to provide closed cycle cooling water to nonsafety-related components to support normal plant operation. The system consists of tanks, pumps and associated valves and piping to the nonsafety-related equipment.

The system contains safety-related components and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). These safety-related components are evaluated with the containment penetrations system (Section 2.3.2.4).

Domestic Water

The purpose of the domestic water system is to provide makeup water to plant systems and supply water for domestic use (drinking water, sinks, etc.). The domestic water system consists of tanks, pumps, and the associated piping and valves.

Drain Collection Header

The purpose of the drain collection header system is to provide a drain flow path for numerous components in the auxiliary building. The system consists of piping and valves.

Liquid Radwaste Management

The purpose of the liquid radwaste management system is to collect and process the liquid radioactive waste water. The system includes pumps, piping, valves, and tanks that collect, transport, and store the liquids.

Plant Heating

The purpose of the plant heating system is to provide hot water for plant heating. It includes a boiler, pumps, piping, valves, and area heaters.

This system includes safety-related components at the containment penetration and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). These components are evaluated with the containment penetrations system in Section 2.3.2.4. The system contains a valve that is required for the fuel oil pressure boundary to the fire diesel and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). This valve is included in the fuel oil system evaluation in Section 2.3.3.7.

Post-Accident Sampling System

The purpose of the post-accident sampling system was to provide post-accident sampling of the containment. The system includes piping, valves, coolers, pumps, sample containers, and detectors to allow the samples to be drawn and analyzed.

Primary Sampling

The purpose of the primary sampling system is to collect and analyze samples from the reactor coolant system and associated auxiliary systems. The system contains heat exchangers, pumps, tanks, valves, piping and other mechanical components. The sampling function is not a safety function.

The primary sampling system contains safety-related components and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The components in this system that are part of the reactor coolant system pressure boundary are evaluated with the reactor coolant system in Section 2.3.1. The components in this system that are part of the ECCS pressure boundary are evaluated with the ECCS in Section 2.3.2.1. The containment penetration components are evaluated with the containment penetrations in Section 2.3.2.4.

Regenerative Waste

The purpose of the regenerative waste system is to process and regenerate radioactive waste water. This system was originally designed with radioactive waste evaporators that are no longer utilized. The system contains pumps, tanks, filters, valves, piping and other miscellaneous mechanical components.

Resin Transfer

The purpose of the resin transfer system is to transfer resin for the various site demineralizers. The system includes valves and piping.

Sampling System

The purpose of the sampling system is to collect samples from plant systems to ensure proper chemistry control is being maintained. The sampling system consists of pumps, heat exchangers, filters, valves, tanks, piping and other miscellaneous components.

The system includes safety-related piping and valves at containment penetrations that have the safety function of maintaining the steam generator secondary pressure boundary and containment integrity under accident conditions. The system is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The steam generator secondary side pressure boundary as maintained by these components is required during a safe shutdown following a fire. The system is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). These components are evaluated with the containment penetrations system in Section 2.3.2.4.

Shutdown Cooling

The purpose of the shutdown cooling (SDC) system is to provide cooling of the RCS without reliance on the steam generators. The SDC system consists of heat exchangers, valves, tanks, piping, and other miscellaneous components.

Certain SDC components are also used for post-accident operation as part of the low pressure safety injection system. The system is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The system contains components that are required for safe shutdown following a fire and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). These components are evaluated in Section 2.3.2.1 with the emergency core cooling system.

Spent Resin

The purpose of the spent resin system is to facilitate the transfer and storage of resin from the site demineralizers before their disposal. The system consists of tanks, pumps, filters, valves, piping and other miscellaneous mechanical components.

Startup and Blowdown Demineralizers

The purpose of the startup and blowdown demineralizer (BD) system is to remove impurities from condensate and steam generator water inventory. The BD system starts at the blowdown lines at the steam generators and includes the blowdown heat exchangers tank, the blowdown demineralizers, blowdown pumps, and the associated piping and valves. The majority of the system components outside of containment are not safety-related.

The components in containment are safety-related to provide a closed loop inside the containment building for containment integrity. The system is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The system must isolate to control the steam generator inventory under accident conditions and during safe shutdown following a fire when the steam generators are fed by emergency feedwater. The system is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). These components are evaluated with the containment penetrations in Section 2.3.2.4.

Steam Generator Secondary / Blowdown

The steam generator secondary / blowdown system (SGS) includes instrumentation valves, tubing, and piping on the steam generator secondary side as well as components in the steam generator blowdown subsystem. The purpose of the instrumentation piping and valves is to sense the steam generator secondary side conditions and provide a main steam system pressure boundary. The steam generator instrumentation is needed for pressure boundary integrity and indication of steam generator secondary side conditions during safe shutdown following a fire.

The SGS contains safety-related components and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The system contains components that are required for safe shutdown following a fire and is therefore also within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). These components are included in the evaluations for main steam and main feedwater in Section 2.3.4.1 and Section 2.3.4.2, respectively.

Turbine Building Sump

The purpose of the turbine building sump system is to provide the floor drains for components in the turbine building and other areas such as the EFW and EDG rooms. The system consists of pumps, filters, valves, piping and other miscellaneous mechanical components.

SAR References

System	SAR Section
Auxiliary building sump	Section 9.3.3
Auxiliary cooling water	Section 9.2.1
Auxiliary steam	Section 10.2.2
Boron management	Section 11.2.2.1
Chemical addition	Section 10.3.5
Chilled water	Section 9.4
Circulating water	Section 10.4.5
Component cooling water	Section 9.2.2
Domestic water	Section 9.2.4
Drain collection header	Section 11.2.2.2
Liquid radwaste management	Section 11.2
Plant heating	Not applicable
Post-accident sampling	Section 9.3.2.2.4
Primary sampling	Section 9.3.2
Regenerative waste	Section 11.2
Resin transfer	Section 11.4
Sampling	Section 9.3.2
Shutdown cooling	Section 9.3.6
Spent resin	Section 11.5.2
Startup and blowdown demineralizers	Section 10.4.10
Steam generator secondary / blowdown	Section 10.4.8
Turbine building sump	Section 9.3.3

Components Subject to AMR

Table 2.3.3-11 lists the component types requiring aging management review based on the criterion of 10 CFR. 54.4(a)(2) for the systems listed.

Table 3.3.2-11 provides the results of the aging management review.

License Renewal Drawings

Systems that are included in scope only as nonsafety-related affecting safety-related due to a potential spatially related failure do not have references to license renewal drawings. This is the result of the location based scoping evaluation and the identification of in-scope components as commodities within the bounds of a given structural area rather than equipment highlighted on a flow diagram.

Containment isolation components are indicated on the license renewal drawings referenced in Section 2.3.2.4. Components reviewed as part of another system are indicated on the license renewal drawings referenced in the respective system section.

2.3.3.12 Other Miscellaneous Systems

System Description

This section discusses various systems within the scope of license renewal with components subject to aging management review that have been included in the mechanical system reviews of other systems or the structural reviews. The system descriptions include discussions of the components subject to aging management review and references to the sections containing the component evaluations. Systems described in this section are intake structure [ventilation], nitrogen supply, service air, traveling screen wash, and ventilation system.

Intake Structure [Ventilation]

Intake structure [ventilation] consists of ventilation components in the intake structure that support fire protection and service water system functions. These components are classified in the component database as intake structure system components but are evaluated with the systems supported (see Section 2.3.3.2, Water Suppression Fire Protection, and Section 2.3.3.8, Service Water). The intake structure itself is described in Section 2.4.3.

The ventilation supporting the service water pumps is safety related and therefore the intake structure [ventilation] is within the scope of license renewal based on the criterion of 10CFR54.4(a)(1). The ventilation for the fire protection components is required for compliance with Commission’s regulations for fire protection (10CFR50.48) and the system is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(3).

Nitrogen Supply

The purpose of the nitrogen supply (N2) system is to provide pressurized nitrogen gas for site components such as the safety injection tanks, the steam generator secondary, and the CVCS charging pump pulsation dampeners and suction stabilizers. The N2 system also provides nitrogen to safety-related electrical penetrations to prevent leakage under accident conditions. The nitrogen system includes containment penetration components that are required for containment isolation under accident conditions as well as valves and piping for supplying the nitrogen.

N2 system components that are subject to aging management review are evaluated in Section 2.3.2.4, Containment Penetrations, Section 2.3.3.5, Chemical and Volume Control, and Section 2.3.4.1, Main Steam.

The nitrogen supply system contains safety-related components and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(1).

Service Air

The purpose of the service air system is to provide compressed air for service air outlets located throughout the plant site which will be used for operation of pneumatic tools. The service air system consists of air compressors, air receivers, piping and valves.

The service air system contains several safety-related containment isolation valves which are evaluated in Section 2.3.2.4. The safety-related fuel transfer tube gasket air test isolation valve is evaluated with the spent fuel pool system in Section 2.3.3.1. The system is within the scope of license renewal based on the criterion of 10CFR54.4(a)(1).

Traveling Screen Wash

The purpose of the traveling screen wash system for ANO-2 is to filter water from Lake Dardanelle before it is supplied to the service water bays. Two traveling water screens in the ANO-2 intake structure are included in this system code along with their motors, gearboxes, and controls and the associated ANO-2 screen wash piping and valves. Water from the ANO-1 screen wash system provides spray water to wash the ANO-2 traveling water screens as they travel past the spray nozzles. The debris can be sluiced to trash collection baskets.

The system contains no safety-related components but is conservatively included in the scope of license renewal to be consistent with the evaluation of the traveling screen wash system in the ANO-1 license renewal Safety Evaluation Report. No components are subject to aging management review as they are either active components or do not perform an intended function. Consistent with the ANO-1 license renewal SER, the traveling water screens are considered active devices. The supporting structural components are reviewed as required in structural evaluations.

Ventilation System

The purpose of the ventilation system is to provide a suitable environment for equipment and personnel for various structures on the ANO site, including the AAC diesel generator building. The system consists of blowers, heating coils, filters, dampers, ductwork and other miscellaneous mechanical components. The system does not include safety-related components or perform a safety function, but the AAC diesel generator building ventilation is required for the AAC diesel to function during SBO or for safe shutdown following a fire. Thus the system contains components that are required for SBO and safe shutdown following a fire and is therefore within the scope of license renewal based on the criterion of 10CFR54.4(a)(3). The AAC ventilation components are evaluated with the AAC diesel in Section 2.3.3.4.

SAR References

System/Component	SAR Section
Intake structure [ventilation]	Section 9.4.6 (service water pump ventilation)
Nitrogen supply	Section 6.3.2 discusses the SI Tank nitrogen supply Section 8.3.1.1.13 identifies the electrical penetration nitrogen supply Section 9.3.4 discusses the CVCS nitrogen supply
Service air	Section 9.3.1
Traveling screen wash	Section 9.2.1
Ventilation	Section 8.3.3 discusses the AAC diesel generator building ventilation

Table 2.3.3-1
Spent Fuel Pool System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Fuel transfer tube	Pressure boundary
Piping	Pressure boundary
Spent fuel racks	Structural support [Criterion a(1) equipment]
Valve	Pressure boundary

Table 2.3.3-2
Water Suppression Fire Protection System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Air dryer housing	Pressure boundary
Blower housing	Pressure boundary
Bolting	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Expansion joint	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Gear housing	Pressure boundary
Governor housing	Pressure boundary
Heat exchanger (housing)	Pressure boundary
Heat exchanger (shell)*	Heat transfer Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Nozzle	Flow control Pressure boundary
Orifice	Flow control
Pipe / fittings	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet and tube sheet for this system.

Table 2.3.3-3
Emergency Diesel Generator System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blower housing	Pressure boundary
Bolting	Pressure boundary
Booster housing	Pressure boundary
Distributor housing	Pressure boundary
Ejector	Pressure boundary
Expansion joint	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Governor housing	Pressure boundary
Heat exchanger (bonnet)	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heat exchanger (tubesheet)	Pressure boundary
Heater housing	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Silencer	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Unloader	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-4
Alternate AC Diesel Generator System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Air motor housing	Pressure boundary
Blower housing	Pressure boundary
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flex hose	Pressure boundary
Governor housing	Pressure boundary
Heat exchanger (shell)*	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heater housing	Pressure boundary
Indicator housing	Pressure boundary
Lubricator housing	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Silencer	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Flow control Pressure boundary

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet and tube sheet for this system.

Table 2.3.3-5
Chemical & Volume Control System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Gear housing	Pressure boundary
Heat exchanger (shell)*	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Sight glass	Pressure boundary
Sight glass (housing)	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet for this system.

Table 2.3.3-6
Halon Fire Protection and RCP Oil Collection System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Flex hose	Pressure boundary
Indicator housing	Pressure boundary
Nozzle	Pressure boundary
Pan	Pressure boundary
Piping	Pressure boundary
Tank	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-7
Fuel Oil System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flame arrestor	Flow control
Flex hose	Pressure boundary
Heat exchanger (shell)*	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Indicator housing	Pressure boundary
Injector housing	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

*Heat exchanger (shell) includes the heat exchanger channel head/bonnet and tube sheet for this system.

Table 2.3.3-8
Service Water System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blower housing	Pressure boundary
Bolting	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Expansion joint	Pressure boundary
Filter	Filtration
Filter housing	Pressure boundary
Flow straightener	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-9
Auxiliary Building Ventilation System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blower housing	Pressure boundary
Bolting	Pressure boundary
Cooling coil housing	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Expansion joint	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.3-10
Control Room Ventilation System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Blower housing	Pressure boundary
Bolting	Pressure boundary
Compressor casing	Pressure boundary
Cooling coil housing	Pressure boundary
Damper housing	Pressure boundary
Ductwork	Pressure boundary
Expansion joint	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (bonnet)*	Pressure boundary
Heat exchanger (shell)	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Indicator housing	Pressure boundary
Piping	Pressure boundary
Sight glass	Pressure boundary
Sight glass (housing)	Pressure boundary
Silencer	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

*Heat exchanger (bonnet) includes the heat exchanger tube sheet for this system.

Table 2.3.3-11
Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Pressure boundary
Filter housing	Pressure boundary
Heat exchanger (shell, channel head)	Pressure boundary
Heat exchanger (heating or cooling coil when not enclosed in a housing)	Pressure boundary
Level glass gauge	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary
Ventilation unit housing	Pressure boundary

2.3.4 Steam and Power Conversion Systems

The following systems are included in this section.

- main steam
- main feedwater
- emergency feedwater

2.3.4.1 Main Steam

System Description

The purpose of the main steam (MS) system is to convey steam from the steam generators to the turbine generator and to other auxiliary equipment for power generation. The MS system supplies steam to the high pressure turbine and to the moisture separator reheaters during normal plant operation, to the turbine gland seals during low load, and to the main feedwater pump steam turbine drivers during low loads or whenever low pressure steam is not sufficient. The main steam system provides steam to the supply header for the turbine-driven emergency feedwater pump turbine that is required for accident conditions and for safe shutdown following a fire.

The main steam system forms part of the closed system inside containment for containment integrity under accident conditions.

This system contains nonsafety-related components whose failure could impact safety-related components. These components are evaluated in Section 2.3.3.11.

Main steam pressure control following a fire is a function performed by this system to control the cooldown of the reactor coolant system. The local control of the atmospheric dump valve or its upstream isolation valve will control the steaming rate and the plant cooldown rate for safe shutdown.

Certain components in the nitrogen supply system are evaluated with the main steam system. These are associated with the nitrogen supply to the secondary side of the steam generator. Certain EFW components in the main steam supply to the EFW turbine are also evaluated with the main steam system as are components from the steam generator secondary/blowdown system.

The main steam system is within the scope of license renewal based on the criteria 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Sections 10.3 and 15.1.1.18 discuss the main steam system.

Components Subject to Aging Management Review

Table 2.3.4-1 lists the component types that require aging management review.

Table 3.4.2-1provides the results of the aging management review.

The components in the instrument air supply to the main steam isolation valves (MSIV) are safety-related but do not require an aging management review since the MSIV closes (safe position) on a loss of air pressure.

License Renewal Drawings

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

LRA-M-2206 Sh. 1

2.3.4.2 Main Feedwater

System Description

The purpose of the main feedwater (FW) system is to provide feedwater to the steam generators to support normal operations. The main feedwater system functions to provide a flow path for emergency feedwater to the steam generators and to isolate feedwater flow to the steam generators during a main steam or feedwater line break event or containment overpressurization. The system is made up of two interconnected trains, consisting of steam-driven main feedwater pumps, pump recirculation valves, feedwater flow control valves, feedwater heaters, feedwater block valves, vent and drain valves, and associated piping and tubing.

The main feedwater system is largely nonsafety-related but has a safety-related portion that provides isolation to the steam generators following a main steam or feedwater line break or containment building overpressure condition. The safety-related portion of the system is the piping and related equipment starting with the main feedwater block valve closest to containment and continuing to the steam generators. The second block valve (outboard) on each train is also safety-related, but the piping and valves between the two block valves are not safety-related.

This system contains nonsafety-related components whose failure could impact safety-related components. These components are evaluated in Section 2.3.3.11.

The pressure boundary integrity for FW is provided by the main feedwater block valves, piping and steam generators, which are credited in conjunction with MS for RCS decay heat removal for safe shutdown after a fire. These components perform a function that demonstrates compliance with the Commission's regulations for fire protection (10CFR50.48).

Steam generator level monitoring components, which are classified as part of the steam generator secondary/blowdown system, are evaluated with the main feedwater system. These components provide monitoring of the steam generator water level for power operations and safe plant shutdown.

The main feedwater system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and10CFR54.4(a)(3).

<u>SAR References</u>

Section 10.4.7.2 discusses the main feedwater system.

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

Table 2.3.4-2 lists the component types that require aging management review.

Table 3.4.2-2 provides the results of the aging management review.

<u>License Renewal Drawings</u>

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

LRA-M-2206 Sh. 1

2.3.4.3 Emergency Feedwater

<u>System Description</u>

The purpose of the emergency feedwater system is to provide a safety-related source of feedwater to the steam generators when main feedwater is not available. The system is the safety-related source of feedwater for cooling during design basis events and is credited with operation for safe shutdown following a fire.

The emergency feedwater system (EFWS) consists of two safety-related pumps (one turbine-driven and one motor-driven), a third nonsafety-related auxiliary feedwater pump, and two independent feedwater trains, each capable of supplying feedwater to either of the two steam generators. The EFWS is supplied from the condensate storage tanks backed up by the safety-related service water system.

The evaluation of the EFWS includes the condensate storage and transfer (CT) system. The CT system consists of two condensate storage tanks, two condensate transfer pumps, and associated piping, controls, and instrumentation. The safety-grade condensate storage tank is connected to the Unit 2 EFW system as an available source of EFW. It is isolated from the system by locked closed double isolation valves.

This system contains nonsafety-related components whose failure could impact safety-related components. These components are evaluated in Section 2.3.3.11.

The emergency feedwater system is required for compliance with the Commission's regulations for fire protection (10CFR50.48).

EFW suction supply valves from the service water system are evaluated with the service water system (Section 2.3.3.8) due to the raw water environment internal to these valves. Certain EFW components in the main steam supply to the EFW turbine are evaluated with the main steam system (Section 2.3.4.1).

The emergency feedwater system is within the scope of license renewal based on the criteria of 10CFR54.4(a)(1), 10CFR54.4(a)(2), and 10CFR54.4(a)(3).

SAR References

Sections 9.2.6 and 10.4.9 discuss the emergency feedwater system.

Components Subject to Aging Management Review

Table 2.3.4-3 lists the component types that require aging management review.

Table 3.4.2-3 provides the results of the aging management review.

License Renewal Drawings

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

LRA-M-204 Sh. 5
LRA-M-2202 Sh. 4
LRA-M-2204 Sh. 4
LRA-M-2206 Sh. 1

Table 2.3.4-1
Main Steam System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Expansion joint	Pressure boundary
Orifice	Pressure boundary
Piping	Pressure boundary
Steam trap	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.4-2
Main Feedwater System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bolting	Pressure boundary
Piping	Pressure boundary
Tubing	Pressure boundary
Valve	Pressure boundary

Table 2.3.4-3
Emergency Feedwater System
Components Subject to Aging Management Review

Component Type	Intended Function(s)
Bearing housing	Pressure boundary
Bolting	Pressure boundary
Equalizer pipe	Pressure boundary
Filter housing	Pressure boundary
Governor housing	Pressure boundary
Heat exchanger (tubes)	Heat transfer Pressure boundary
Heat exchanger (tubesheet)	Pressure boundary
Heater housing	Pressure boundary
Orifice	Flow control Pressure boundary
Piping	Pressure boundary
Pump casing	Pressure boundary
Servo housing	Pressure boundary
Sight glass	Pressure boundary
Sight glass (housing)	Pressure boundary
Steam trap	Pressure boundary
Tank	Pressure boundary
Thermowell	Pressure boundary
Tubing	Pressure boundary
Turbine casing	Pressure boundary
Valve	Pressure boundary

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

The major structures within the scope of license renewal are the containment building, auxiliary building, turbine building, and intake structure. The containment building, auxiliary building, and portions of the intake structure house safety-related equipment. The evaluation of containment (Section 2.4.1) includes the containment building and the internal structures. The evaluation of the auxiliary building (Section 2.4.2) includes portions of the turbine building, yard structures and structural components that support and protect the safety-related equipment in these structures. The evaluation of the intake structure (Section 2.4.3) includes the intake structure, the emergency cooling pond and structural components that support and protect the safety-related equipment in these structures.

Structural commodities (piping and conduit supports, electrical cabinets, tank foundations, etc.) are addressed in the bulk commodities review (Section 2.4.4).

2.4.1 Containment and Containment Internals

Description

The ANO-2 containment is a seismic Category 1, fully continuous, reinforced prestressed concrete cylindrical structure with a shallow dome roof and a mat foundation slab. The containment completely encloses the containment internals, the reactor vessel, and the reactor coolant system along with other vital electrical, mechanical, instrumentation, and structural components. The containment consists of three basic parts: (1) a flat circular base slab, (2) a right circular cylinder, and (3) a sphere-torus dome. It is constructed of reinforced concrete prestressed by post-tensioned tendons in the cylinder and the dome.

The containment houses the containment internal structures. The internal structures consist of the primary shield, secondary shield, refueling canal, removable missile shield above the reactor vessel, floor slabs, gratings and platforms, and equipment supports. Structures associated with the containment internals comprise structural members such as beams, girders, joists, columns, base plates, bearing plates, bracing, splice assemblies, connections, and other related steel items. The major structural steel components consist of the upper steam generator and reactor coolant pump restraints, lower steam generator support (which includes steam generator support steel), reactor support and pressurizer support steel.

The purpose of the containment structure is to limit the release of radioactive fission products following an accident to limit the dose to the public and the control room operators. The containment structure also provides physical support for itself, the reactor coolant system, engineered safety features, and other systems and equipment within the structure. The exterior walls and dome provide protection for the reactor vessel and other safety-related SSCs from missiles (internal and external) and natural phenomena.

SAR References

Additional details of the containment building can be found in SAR Sections 3.8.1 and 3.8.3.

Evaluation Boundaries

The following structures, systems, and components are evaluated for the containment building.

- Anchors/embedments/attachments for systems/components
- Building foundations
- Concrete beams
- Containment concrete cylinder wall
- Containment dome, includes coatings on roof
- Containment sump structure (excluding piping, equipment, instrumentation, and controls associated with the sump)
- Doors/hatches and hatch covers
- Equipment hatch
- Exterior and interior concrete walls
- Floor and roof slabs
- Fuel handling bridge, crane rails and supports
- Fuel transfer canal (excludes tube portion and flanges)
- Mechanical and electrical penetrations
- Missile shield walls
- Personnel airlock, emergency airlock
- Pipe supports, cable trays and other equipment supports (includes whip restraints) and conduits
- Polar crane rails and crane support structures
- Radiation shield walls
- Reactor vessel closure head lifting rig assembly structure and miscellaneous components
- Reactor structural supports (concrete and steel)
- Stairways, platforms, ladders, handrails, gratings, catwalks
- Steam generator structural supports (concrete and steel)
- Steel floor framing, columns, and bracing
- Steel beams
- Structural bolting
- Structural steel that supports grating and catwalks, service platforms, ladders and stairs (required for general access)
- Structural steel members and shapes (includes steam generator, pressurizer, reactor vessel, reactor coolant pumps, and safety injection tank support steel)
- Tank supports (concrete and steel)

The supports for the reactor coolant system components (the reactor vessel, reactor coolant pumps, steam generators, and pressurizer) are considered unique and are included in this evaluation. Other component and piping supports, including RCS piping supports, are addressed in the bulk commodity evaluation.

Components Subject to AMR

Table 2.4-1 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-1 provides the results of the aging management review.

2.4.2 Auxiliary Building, Turbine Building and Yard Structures

Description

The ANO-2 auxiliary building is a seismic Category 1 structure. The auxiliary building houses various systems that support operation of ANO-2. It is a conventionally designed, reinforced concrete structure founded on bedrock east of the ANO-2 containment. The auxiliary building consists of a reinforced concrete foundation, reinforced concrete floor slabs, and a tiered reinforced concrete roof with an elastomeric coating or sheet metal roof decking with built-up roofing on rigid insulation. The building is partly above grade (grade is at elevation 354’-0”) and partly below grade. Exterior concrete construction joints contain waterstops at joints below the plant’s design flood level.

The auxiliary building contains reinforced masonry block walls that subdivide building areas into separate rooms. They may be seismic Category 1 or seismic Category 2. Block walls may be fire barriers required for compliance with 10CFR50.48. Masonry block walls considered to have a safety function must meet the requirements of NRC IE Bulletin 80-11.

The spent fuel pool’s concrete walls are resistant to missiles and are lined with a stainless steel liner plate. The liner plate protects the concrete walls from borated water leakage.

The PASS building contains Category 2 equipment, but it is designed to Seismic Category 1 criteria to avoid potential interaction with safety systems. It is also flood-tight.

The turbine building is within the scope of license renewal since it contains fire protection commodities (e.g., fire doors, walls) and electrical cables required for regulated events listed in 10CFR54.4(a)(3).

Generally, yard structures within the scope of license renewal are seismic Category 1 and their structural function is to provide support and protection to seismic Category 1 and seismic Category 2 equipment. A description of some of these structures is provided below.

The foundation for the safety-related condensate storage tank (CST), T41B, is a seismic Category 1 structural component on the west side of the ANO-1 containment. The tank is supported on a reinforced concrete mat foundation. Two valve pits are partially underneath and on opposite (north and south) sides of the mat foundation. The south valve pit is for ANO-1 and the north valve pit serves ANO-2. A reinforced concrete wall surrounds the lower portion of the tank to protect against loss due to an external missile. The missile wall is integral to the safety-related condensate storage tank foundation mat.

A reinforced concrete pipe trench runs from T41B to the ANO-2 auxiliary building wall. It is surrounded by backfill material and situated on natural soil or backfill material. A section through the trench is shown in SAR Figure 3.8-34.

The emergency diesel fuel oil storage tank vault is a rigid reinforced concrete box structure on the northwest side of containment. It contains four diesel fuel storage tanks (T57A, T57B, 2T57A, and 2T57B) in separate rooms to provide protection against fire and flooding. The walls are designed to withstand hydrostatic loading over their full height. The structure has a mat foundation founded on rock. Entry to the vault is through a watertight door. Additionally, each storage tank room is separated from the others by a 3-hour fireproof door.

The AAC generator building is a seismic Category 2 structure north of and adjacent to the north side berm of the bulk fuel oil storage tank (T-25). The building is of steel-framed pre-cast concrete construction with a steel-framed roof and reinforced concrete slab, founded on grade beams supported by drilled in piers (caissons). This building houses the engine generator set, fuel oil transfer pump, fuel oil day tank, air start system, engine generator control cabinets, HVAC, and fire protection systems.

Seismic Category 1 electrical manholes 2MH01, 2MH02, and 2MH03 are at various locations on the plant site. They are relatively small reinforced concrete structures founded either on natural soil or backfill materials. These partially underground structures are surrounded by backfill material. An access opening in the top slab, at grade level, is provided with a missile resistant steel or reinforced concrete cover.

The refueling water tank (RWT), 2T-3, is on a concrete slab that is part of the auxiliary building. The slab is the roof of the 2T12 tank vault (Room 2020). A small ring wall, filled with oiled sand, was placed on the top of the concrete slab to separate the tank bottom from the concrete.

SAR References

Additional details of the auxiliary building, turbine building and yard structures can be found in SAR Sections 3.8.4.1.1, 3.8.4.1.5, 3.8.4.1.6, 3.8.4.1.7, 6.2.2.2.1.B, and 8.3.3.2.1.

Evaluation Boundaries

The following structures and components are evaluated for the auxiliary building, turbine building, and yard structures.

- AAC generator building
- Auxiliary building sump (except valves, piping)
- Building foundations
- Concrete beams
- Crane rails and crane support structures
- Doors (e.g., flood doors, fire doors)
- External penetrations, and louvers
- Embedded items (including conduit, unistrut and anchors)
- Exterior and interior concrete walls
- Floor and roof slabs
- Fuel transfer tube support
- HELB barriers such as walls, floors, and doors
- Main transformer foundations
- Manway hatches (concrete and steel)
- Masonry block walls
- Miscellaneous structural steel floor framing, columns, bracing, platforms, and catwalks
- New fuel racks
- Outside electrical concrete manholes and underground ducts
- Outside pipe trenches
- Pipe supports, cable trays, conduits and other equipment supports
- Safety-related CST (T-41B) foundation and pipe trenches
- Refueling water tank (2T-3) foundation
- Superstructure framing (over spent fuel pool)
- Sump structures excluding piping, equipment, instrumentation, and controls associated with the sump
- Spent fuel pool concrete and liner plate
- Spent fuel pool bulkhead gates
- Spent fuel crane (L3)
- Steel beams
- Stairways, platforms, ladders, handrails, gratings, catwalks
- Steel floor framing, columns, and bracing
- Tank foundations
- Unit auxiliary transformer foundations
- Start-up #3 transformer foundations
- Transformer yard concrete firewalls/missile barriers

- Transformer bus structural steel supports and foundations
- Switchyard start up #3 voltage regulator foundation
- Switchyard bus structural steel supports and foundation
- Switchyard circuit breaker 1262F03 foundation

There are no unique supports for the auxiliary building, turbine building and yard structures. The supports will be addressed in the bulk commodity review.

Components Subject to AMR

Table 2.4-2 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-2 provides the results of the aging management review.

2.4.3 Intake Structure and Emergency Cooling Pond

Description

The intake structure is in the southeast corner of the plant site. It is a reinforced concrete Category I structure and is considered an extension of the ANO-1 intake structure. There is no separation between the two structures and both are founded on rock. It provides support for a common gantry crane to service the equipment. The structure can be generally divided into two major sections. The first section is the portion of the building above grade elevation (el. 353'-3"). The remaining section is the pump bay area below grade and partially submerged in water. The intake section of the building has two bays. The back section of the building is a box-type structure that houses the major equipment (e.g., SW pumps and associated equipment). The above grade section consists of three predominant elevations: el. 354'-0", el. 366'-0", and el. 378'-0". Missile shield walls are provided at the exterior of the intake structure doorways. Roof plugs above service water pumps function as missile shields and can be removed to provide maintenance access.

The ANO-1 intake structure is integrally connected to the ANO-2 intake structure with a shear key and a row of reinforcing bars near the el. 354'-0" slabs. The ANO-1 structure houses the common fire pumps and accessories in the Category 1 portion of the structure.

The intake canal associated with the intake structure provides a suction source for fire water and service water pumps. The canal is approximately 4,000 feet long with an average depth of 14 feet. The normal water elevation is el. 338'-0".

The emergency cooling pond is a seismic Category 1, 14-acre, kidney-shaped pond northwest of the plant. Plant discharge (ECP inlet) flows into a structure that is surrounded by a 100 foot long weir. The emergency cooling pond is excavated in an impervious clay stratum with the bottom of the pond above bedrock. The pond side slopes are protected against wave action by riprap placed on the north side of the pond.

SAR References

Additional details of the intake structure and ECP can be found in SAR Sections 9.2.5, 3.8.4.1.2 and 3.8.4.1.4.

Evaluation Boundaries

The following structures, systems, and components are evaluated for the intake structure and ECP.

- Structural steel elements such as floor framing, columns, bracing, platforms, and catwalks
- External penetrations, doors
- Bar grates and fish baskets
- Building foundations
- Concrete beams
- Concrete missile barriers
- Crane rails and crane support structures
- Discharge canal concrete flume
- Embedded items (including unistruts and anchors)
- Exterior and interior concrete walls
- ECP concrete intake
- Emergency cooling pond, intake canal
- Floor and roof slabs (includes portions associated with ANO-1 fire water pump)
- Hatches (includes ANO-1)
- Louvered doors (includes ANO-1)
- Pipe supports, cable trays and other equipment supports
- Service water screens/filters/strainers
- Steel beams
- Traveling screens

There are no unique supports for the intake structure and ECP evaluation. The supports are addressed with the bulk commodities.

Components Subject to AMR

Table 2.4-3 lists the component types requiring aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-3 provides the results of the aging management review.

2.4.4 Bulk Commodities

Description

Structural commodities are structural members that support or protect system components, mechanical piping, electrical lines, and plant equipment. Structural commodities that are unique to a specific structure are evaluated with that structure. Structural commodities which are common to ANO-2 in-scope systems and structures (e.g., anchors, embedments, equipment supports, instrument panels, racks, cable trays, conduits) are evaluated as bulk commodities.

To support a system component within the scope of license renewal, the structure may transfer dead, live, thermal, vibration, impact, seismic, or wind loads applied to or generated by the affected system component. For a structure to perform a protective function for an in-scope system component, the structure must have sufficient strength and resiliency to ensure that the system component is protected from the effects of design basis events such as flood, fire, jet impingement, and missiles.

SAR References

The UFSAR does not contain details of aging effects or aging management of these commodities.

Evaluation Boundaries

The structures, system, and components to be reviewed as bulk commodities include the following.

- Anchor bolts
- Base plates, embedded unistrut
- Battery racks
- Cable tray and conduit supports
- Cable trays
- Component supports
- Damming material (fire barrier)
- Electrical instrument panels and enclosures
- Fire barrier seals
- Fire damper framing (in-wall)
- Fire doors

- Flood curbs
- Floor plugs
- Hatches
- HVAC duct supports
- Instrument line supports
- Instrument racks and frames
- Joint elastomers at seismic gaps
- Lightning protection poles and attachments
- Main steam line support structure
- Manhole covers
- Miscellaneous embedment
- Miscellaneous doors, louvers, wire mesh, safety chains, and safety gates
- Missile barriers
- Monorails, crane rails, and girders
- Threaded fasteners
- Penetration seals
- Pipe sleeves (mechanical/electrical, not penetrating the containment liner plate)
- Piping supports (includes whip restraints)
- RCS component support threaded fasteners (for steam generators, reactor coolant pumps, and pressurizer)
- Roofing
- Stairs, ladders, handrails, catwalks, platforms, and grating
- Support pedestals (pads)
- Trisodium phosphate (TSP) baskets
- Water stops

Components Subject to AMR

Table 2.4-4 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.5.2-4 provides the results of the aging management review.

Table 2.4-1
Containment and Containment Internals
Components Subject to Aging Management Review

Table 2.4-1	
Structure and/or Component/ Commodity	**Intended Function**
Steel	
Anchorage/embedment/attachments	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
CEDM support structure	Shelter or protection Support for Criterion (a)(1) equipment
Electrical penetrations	Pressure boundary Support for Criterion (a)(1) equipment
Equipment hatch	Flood barrier Missile barrier Pressure boundary Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment
Fuel handling bridge, crane rails and supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Liner plate	Flood barrier Pressure boundary Shelter or protection (radiation shielding)
Mechanical penetrations	Pressure boundary Support for Criterion (a)(1) equipment
Personnel airlocks	Flood barrier Missile barrier Pressure boundary
Polar crane (containment)	Support for Criterion (a)(2) equipment
Pressurizer support steel	Support for Criterion (a)(1) equipment
Reactor vessel support column	Support for Criterion (a)(1) equipment

Table 2.4-1 (Continued)	
Structure and/or Component/ Commodity	**Intended Function**
Refuel maintenance support structure	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Steam generator support	HELB shielding Support for Criterion (a)(1) equipment
Structural steel	Missile barrier Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Sump penetrations	Support for Criterion (a)(1) equipment Heat sink
Tendon anchorage	Support for Criterion (a)(1) equipment
Tendon wires	Support for Criterion (a)(1) equipment
Threaded Fasteners	
Reactor vessel support bolted connections	Support for Criterion (a)(1) equipment
Various threaded fasteners	Support for Criterion (a)(1) equipment
Concrete	
Basement floor slab (includes sump and instrumentation tunnel)	Fire barrier Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Columns, other walls, hatches	Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-1 (Continued)

Structure and/or Component/ Commodity	Intended Function
Dome Cylinder wall, buttress, ring girder	Fire barrier Flood barrier Missile barrier Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Foundation, subfoundation	Fire barrier Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Pressurizer support foundation	Support for Criterion (a)(1) equipment
Primary and secondary shield walls	HELB shielding Missile barrier Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Reactor vessel missile shield	Missile barrier Shelter or protection (radiation shielding) Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Refuel canal	Shelter or protection (radiation shielding)
Steam generator support foundation, Reactor vessel support foundation	Support for Criterion (a)(1) equipment

Table 2.4-2
Auxiliary Building, Turbine Building and Yard Structures
Components Subject to Aging Management Review

Table 2.4-2	
Structure and/or Component/Commodity	**Intended Function**
Steel	
AAC generator building (framing and structural shapes)	Support for Criterion (a)(3) equipment
Battery racks	Support for Criterion (a)(1) equipment
Control room extension substructure	Missile barrier
EDG stack vent exterior louvers	Support for Criterion (a)(1) equipment
Exhaust stack supports (EDGs and EFW turbine)	Support for Criterion (a)(1) equipment
Fuel handling bridge assembly (2H3) crane rails and girders	Support for Criterion (a)(1) equipment
HELB doors	HELB shielding
New fuel racks	Support for Criterion (a)(1) equipment
Spent fuel overhead cranes (L3 and 2L35)	Support for Criterion (a)(2) equipment
Spent fuel pool bulkhead gates	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Spent fuel pool liner (auxiliary building)	Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Spent fuel pool superstructure framing (includes associated structural shapes, bars, and plates)	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Switchyard bus structural steel supports Transformer bus structural supports	Support for Criterion (a)(3) equipment

Table 2.4-2 (Continued)	
Structure and/or Component/Commodity	**Intended Function**
Tank 2T12 vault beams	Support for Criterion (a)(1) equipment
Watertight and flood doors	Flood barrier
Concrete	
AAC generator foundation slab	Support for Criterion (a)(3) equipment
Auxiliary building columns and beams	Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Auxiliary building exterior walls, above grade	Fire barrier Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Auxiliary building exterior walls, below grade	Fire barrier Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Auxiliary building floor slabs Auxiliary building interior load-bearing walls	Fire barrier Flood barrier MIssile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Aux building foundation mat	Flood barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Auxiliary building sump	Support for Criterion (a)(1) equipment
Category 1 electrical manholes, walls, slab and ductwork	Fire barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment

Table 2.4-2 (Continued)

Structure and/or Component/Commodity	Intended Function
Category 1 electrical manhole covers	Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Category 1 masonry block walls	Fire barrier Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Emergency diesel fuel oil storage tank vault (walls, floor slab, columns)	Fire barrier Flood barrier Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Fuel oil storage tank T-25 foundation	Support for Criterion (a)(3) equipment
PASS building substructure	Fire barrier Flood barrier Support for Criterion (a)(2) equipment
Roof slabs	Support for Criterion (a)(3) equipment
RWT 2T-3 foundation slab	Support for Criterion (a)(1) equipment
Sodium hydroxide tank 2T10 foundation	Support for Criterion (a)(2) equipment
Spent fuel pool bottom slab and walls	Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Startup #3 transformer foundation	Support for Criterion (a)(3) equipment
Startup #3 transformer concrete firewalls and missile shield	Fire barrier Missile barrier Support for Criterion (a)(3) equipment
Switchyard bus structural foundation	Support for Criterion (a)(3) equipment
Switchyard circuit breaker foundation	Support for Criterion (a)(3) equipment

Table 2.4-2 (Continued)	
Structure and/or Component/Commodity	**Intended Function**
T41B tank foundation, valve pit and pipe trench	Missile barrier Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Tank 2T12 vault and vault room walls (boron holdup tank)	Flood barrier Shelter or protection Support for Criterion (a)(1) equipment
Transformer bus foundation supports	Support for Criterion (a)(3) equipment

Table 2.4-3
Intake Structure and Emergency Cooling Pond
Components Subject to Aging Management Review

Table 2.4-3	
Structure and/or Component/ Commodity	**Intended Function**
Steel	
Beams in service water and circulating water bays	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Floor hatches	Flood barrier
Louvered doors	Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Support for roof hatches	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Missile barrier
Submerged pump shaft supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Concrete	
Building foundation	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Flood barrier
Columns and beams	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
ECP concrete intake	Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Exterior walls, above grade	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Missile barrier
Exterior walls, below grade	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Flood barrier

Table 2.4-3 (Continued)	
Structure and/or Component/ Commodity	**Intended Function**
Floor slabs Interior walls	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Roof slab	Support for Criterion (a)(1) equipment
Earthen Structures	
Emergency cooling pond	Heat sink Support for Criterion (a)(1) equipment Support for Criterion (a)(3) equipment
Intake canal	Support for Criterion (a)(3) equipment

Table 2.4-4
Bulk Commodities
Components Subject to Aging Management Review

Table 2.4-4	
Structure and/or Component/ Commodity	**Intended Function**
Steel	
Base plates	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Cable tray and conduit supports, embedded unistrut	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Components supports (instrument racks, frames, etc.)	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Electrical instrument panels and enclosures	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Fire damper framing	Fire barrier
Fire doors	Fire barrier
Fire hose reels	Support for Criterion (a)(3) equipment
HVAC missile barriers	Missile barrier Shelter or protection
Main steam line support structure	Support for Criterion (a)(1) equipment
Monorails, crane rails and girders	Support for Criterion (a)(2) equipment
Pipe sleeves (not penetrating containment liner plate)	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Piping supports	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment

Table 2.4-4 (Continued)

Structure and/or Component/ Commodity	**Intended Function**
Piping whip restraints	Shelter or protection Support for Criterion (a)(1) equipment
Stairs, ladders, platforms and grating (supports)	Support for Criterion (a)(2) equipment
Threaded Fasteners	
Anchor bolts	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Other threaded fasteners	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Reactor cavity missile block tie-downs	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Concrete	
Equipment pads	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Fireproofing	Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Flood curbs	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Flood barrier
Hatches and plugs	Support for Criterion (a)(1) equipment Fire barrier Flood barrier HELB shielding Missile barrier Shelter or protection (radiation shielding)
Missile shields	Missile barrier

Table 2.4-4 (Continued)

Structure and/or Component/ Commodity	Intended Function
Support pedestals	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Elastomers	
Equipment hatch seals	Pressure boundary Support for Criterion (a)(1) equipment
Fire barrier seals	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Flood barrier Fire barrier HELB shielding
Fire wrap	Support for Criterion (a)(2) equipment Support for Criterion (a)(3) equipment
Joint elastomers at seismic gaps	Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment Fire barrier
Penetration seals	Fire barrier Flood barrier HELB shielding Pressure boundary Shelter or protection Support for Criterion (a)(1) equipment Support for Criterion (a)(2) equipment
Water stops	Flood barrier

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

Description

As stated in Section 2.1.1, plant electrical and instrument and control systems are included in the scope of license renewal as are electrical and instrumentation and control components in mechanical systems. The default inclusion of plant electrical and I&C systems in the scope of license renewal reflects the method used for the integrated plant assessments (IPA) of electrical systems, which is different from the methods used for mechanical systems and structures.

The basic philosophy used in the electrical and I&C components IPA is that components are included in the review unless they are specifically screened out. When used with the plant spaces approach, this method eliminates the need for unique identification of each component and its specific location. This assures components are not excluded from an aging management review.

The electrical and I&C IPA began by grouping the total population of components into commodity groups. The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified.

During the IPA, commodity groups and specific plant systems were eliminated from further review as the intended functions of commodity groups were examined.

In addition to the plant electrical systems, certain switchyard components required to restore offsite power were conservatively included even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for station blackout (10CFR50.63). The evaluation boundaries of the offsite power system are described below.

The purpose of the offsite power system is to provide the electrical interconnection between the Unit 2 generator and the offsite transmission network. The system also provides the electrical interconnections between the offsite network and the station auxiliary buses, as well as other buildings and facilities on site.

At ANO-2 the equipment relied upon to support 10CFR50.63 is that required to ensure the reactor core is cooled and the containment integrity is maintained using station batteries and the alternate AC diesel generator before offsite or onsite AC power is restored. Systems and structures relied upon to restore offsite AC power (including the on-site portion of the offsite power sources) and onsite AC power are conservatively included within the license renewal scope for SBO. Therefore, this system has the intended function of supporting recovery from station blackout.

SAR References

Additional details for electrical commodities can be found in SAR Chapters 7 and 8.

Evaluation Boundaries

The only offsite power source required to support SBO recovery actions is the source fed through the startup transformer. Specifically, the path includes the switchyard circuit breakers feeding the startup transformer, the startup transformer, the circuit breaker-to-transformer and transformer-to-onsite electrical distribution interconnections, and the associated control circuits and structures.

Components Subject to AMR

Table 2.5-1 lists the component types that require aging management review. Intended functions are defined in Table 2.0-1.

Table 3.6.2-1 provides the results of the aging management review.

The insulated cables and connections group contains the electrical cables used in instrumentation circuits that are sensitive to a reduction in conductor insulation resistance, such as high range radiation monitors and neutron flux detectors. However, at ANO-2 these cables are not subject to aging management review because they are EQ cables. EQ equipment is not subject to aging management review because it is not long-lived. EQ analyses are evaluated as TLAAs in Section 4.4.

Table 2.5-1
Electrical and Instrumentation and Control Systems
Components Subject to Aging Management Review

Structure and/or Component/Commodity	Intended Function
Electrical cables and connections not subject to 10CFR50.49 EQ requirements	CE
Inaccessible medium-voltage (4.16kV to 34.5kV) cables (e.g., installed in conduit or direct buried) not subject to 10CFR50.49 EQ requirements	CE
Electrical connectors not subject to 10CFR50.49 EQ requirements that are exposed to borated water leakage	CE
Switchyard bus (switchyard bus for SBO) bus bars, connections	CE
High voltage insulators	IN

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the aging management review for structures and components identified in Section 2 as subject to aging management review. Table 3.0-1, Table 3.0-2, and Table 3.0-3 provide descriptions of the mechanical, structural, and electrical service environments, respectively, used in the AMRs to determine aging effects requiring management.

Results of the AMRs are presented in the following two table types.

- **Table 3.x.1** where

  3 indicates the table pertaining to a Chapter 3 aging management review,

  x indicates the table 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 is Table 3.1.1,and in the engineered safety features subsection, this is Table 3.2.1. For ease of discussion, these tables will hereafter be referred to as "Table 1." These tables are derived from the corresponding tables in NUREG-1801, Volume 1, and present summary information from the AMRs.

- **Table 3.x.2-y** where

  3 indicates the application section number,

  x indicates the table number from NUREG-1801, Volume 1,

  2 indicates that this is the second table type in Section 3.x, and

  y indicates the system table number.

  For example, within the reactor coolant system subsection, the AMR results for the reactor vessel and CEDM pressure boundary are presented in Table 3.1.2-1, and the results for the reactor vessel internals are in Table 3.1.2-2. In the engineered safety features subsection, the emergency core cooling system results are presented in Table 3.2.2-1, and the containment spray system is in Table 3.2.2-2. For ease of discussion, these tables will hereafter be referred to as "Table 2." These tables present the results of the AMRs.

TABLE DESCRIPTION

NUREG-1801 contains the NRC Staff's generic evaluation of existing plant programs. It documents the technical basis for determining whether existing programs are adequate without modification or should be augmented for the extended period of operation. Evaluation results documented in the report indicate that many existing programs are adequate, without modification, to manage the aging effects for particular structures or components within the scope of license renewal. The report also contains recommendations on specific areas for which existing programs should be augmented for license renewal.

To take full advantage of NUREG-1801, ANO-2 AMR results have been compared with information set forth in the tables of NUREG-1801. Results of that comparison are provided in the following two table types, Table 1 and Table 2.

Table 1

The purpose of Table 1 is to provide a summary comparison of how the ANO-2 AMR results align with the corresponding table of NUREG-1801, Volume 1. These tables are essentially the same as Tables 1 through 6 provided in NUREG-1801, Volume 1, with the following exceptions:

- 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 a means to cross-reference from Table 2 to Table 1.

Further information is provided in the "Discussion" column. The following are examples of information that might be contained within this column:

- Any "Further Evaluation Recommended" information or reference to the location of that information;
- The name of a plant-specific program being used;
- Exceptions to the NUREG-1801 assumptions;
- A discussion of how the line item is consistent with the corresponding line item in NUREG-1801, Volume 1, when it may not be intuitively obvious;
- A discussion of how the line item is different than the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent.

Table 2

Table 2 provides the detailed results of the AMRs for those structures and components identified in Section 2 of this application as being subject to aging management review. There will be a Table 2 for each of the AMR systems (see Section 2.2) within a NUREG-1801 system group. For example, the engineered safety features system group contains tables specific to emergency core cooling, containment spray, containment cooling, containment penetrations, and hydrogen control.

Table 2 consists of the following nine columns.

Component Type

Column 1 identifies the component types from Section 2 of this application that are subject to aging management review. Similar to Section 2, component types are listed in alphabetical order. In the structural tables in Section 3.5, component types are sub-grouped by material.

Intended Function

Column 2 identifies the license renewal intended functions (using abbreviations where necessary) for the listed component types. Definitions and abbreviations of intended functions are listed in Table 2.0-1 in Section 2.

Material

Column 3 lists the particular materials of construction for the component type being evaluated.

Environment

Column 4 lists the environment to which the component types are exposed. Internal and external service environments are indicated. A description of these environments is provided in Table 3.0-1, Table 3.0-2, and Table 3.0-3 for mechanical, structural, and electrical components, respectively.

Aging Effect Requiring Management

Column 5 lists the aging effects identified as requiring management for material and environment combinations for each component type.

Aging Management Programs

Column 6 lists the programs used to manage the aging effects requiring management.

NUREG-1801, Vol. 2, Item

Each combination of the following factors listed in Table 2 is compared to NUREG-1801, Volume 2, to identify consistencies:

- Component type,
- Material,
- Environment,
- Aging effect requiring management, and
- Aging management program.

Column 7 documents identified consistencies by noting the appropriate NUREG-1801, Volume 2, item number. If there is no corresponding item number in NUREG-1801, Volume 2, for a particular combination of factors, column 7 is left blank.

Table 1 Item

Each combination of the following that has an identified NUREG-1801, Volume 2 item number also has a Table 1 line item reference number:

- Component type
- Material
- Environment
- Aging effect requiring management
- Aging management program

Column 8 lists the corresponding line item from Table 1. If there is no corresponding item in NUREG-1801, Volume 1, column 8 is left blank.

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 Reference 3.0-4. Notes that use numeric designators are specific to ANO-2.

TABLE USAGE

Table 1

Information in the following columns is taken directly from NUREG-1801, Volume 1:

- Component
- Aging Effect/Mechanism
- Aging Management Programs
- Further Evaluation Recommended

The Discussion column explains, in summary, how the ANO-2 evaluations and programs align with NUREG-1801, Volume 1.

Table 2

Table 2 contains the aging management review results and indicates whether or not the results correspond to line items in NUREG-1801, Volume 2. This table provides the following information:

- Component type
- Component intended function
- Material
- Environment
- Aging effect requiring management
- AMP credited

If there is a correlation between the combination in Table 2 and a combination for a line item in NUREG-1801, Volume 2, this will be identified by the NUREG-1801, Volume 2, item number in column 7. If the column is blank, no appropriately corresponding combination in NUREG-1801, Volume 2, was identified.

If a NUREG-1801, Volume 2, line item is identified, the next column provides a reference to a Table 1 row number. This reference corresponds to the NUREG-1801, Volume 2, “roll-up” to the NUREG-1801, Volume 1, tables.

Many of the NUREG-1801 evaluations refer to plant-specific programs. In these cases, the ANO-2 evaluation is considered to be consistent with the NUREG if the other elements are consistent. Any appropriate aging management program is considered a match to the NUREG-1801 program for line items referring to a plant-specific program.

REFERENCES FOR SECTION 3.0

3.0-1 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, U. S. Nuclear Regulatory Commission, July 2001.

3.0-2 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Volumes 1 and 2, U. S. Nuclear Regulatory Commission, July 2001.

3.0-3 NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Nuclear Energy Institute (NEI), Revision 3, April 2001.

3.0-4 Letter from A. Nelson, NEI, to P. T. Kuo, NRC, “U.S. Nuclear Industry’s Proposed Standard License Renewal Application Format Package, Request NRC Concurrence,” dated January 24, 2003.

Table 3.0-1
Service Environments for Mechanical Aging Management Reviews

This table lists the environments for the internal and external surfaces for the mechanical AMRs. Many of the environments are self-explanatory, but additional descriptions have been provided as necessary.

Table 3.0-1	
Environment	**Description**
Class 1 Mechanical Environments	
external ambient	containment building atmosphere with potential for limited periods of leaking borated water and steam
treated borated water	demineralized or chemically purified water that contains boric acid; for the pressurizer, this environment includes steam
treated water	demineralized or chemically purified water; for the steam generator secondary side, this environment includes steam
Non-Class 1 Mechanical Environments	
air	indoor atmosphere
carbon dioxide	carbon dioxide gas from bottled supply
concrete	embedded
condensation	found on cooling unit coils and housings and exterior surfaces of components containing cooled fluids
exhaust gas	diesel engine exhaust
freon	freon gas used in HVAC equipment
fresh raw water	lake water
fuel oil	fuel oil used for combustion engines
halon 1301	bromotrifluoromethane (CF3Br) used as a fire suppression agent
lube oil	lube oil for plant equipment
nitrogen	nitrogen gas from a tank
outdoor air	exposed to the weather

Table 3.0-1	
Environment	**Description**
sand and concrete	material in contact with the bottoms of some tanks
soil	external environment for components buried in soil, includes groundwater
steam > 220°F	steam at a temperature above the thermal fatigue threshold for carbon steel
steam > 270°F	steam at a temperature above the thermal fatigue threshold for stainless steel
treated air	air that is dried
treated borated water	treated water that contains boric acid
treated borated water > 270°F	treated water that contains boric acid at greater than 270° F
treated water	demineralized or otherwise chemically treated water
treated water > 220°F	treated water at a temperature above the thermal fatigue threshold for carbon steel
treated water > 270°F	treated water at a temperature above the thermal fatigue threshold for stainless steel
untreated air	air that is not dried
untreated borated water	leakage that may contain raw water, borated water, and various contaminants

Table 3.0-2
Service Environments for Structural Aging Management Reviews

Environment	Description
Protected from weather	Air with temperature less than 150°F, humidity up to 100% and protected from precipitation
Protected from weather with elevated temperatures	Air with temperature less than 200°F, humidity up to 100% and protected from precipitation
Exposed to weather (includes above grade and below grade)	Exposed to the weather with air temperature less than 115°F, humidity up to 100%
Exposed to raw water	Raw water at ANO-2 is fresh water, defined as raw water having a sodium chloride content below 1000 parts per million. It may be acidic or contain chlorides or sulfates.
Exposed to borated water	Water containing boron

Table 3.0-3
Service Environments for Electrical Aging Management Reviews

Environment	Description
Borated water leakage	Demineralized or chemically purified water that contains boric acid
Heat and/or radiation and air[1]	Containment Operating temperature: 120°F With ohmic heating: 162°F Cumulative radiation dose: 1.31E+07 rads Areas outside containment (harsh areas) Operating temperature: 105°F With ohmic heating: 162°F Cumulative radiation dose: 5.25E+06 rads All other areas (mild areas) Operating temperature: 105°F With ohmic heating: 162°F Cumulative radiation dose: 5.0E+04 rads
Moisture and voltage stress	A wetted environment with a medium-voltage range (4.16kV to 22kV for ANO-2). At ANO-2, these are underground, medium-voltage cables that are energized at least 25% of the time.
Outdoor weather	Temperature up to 105°F, precipitation, negligible radiation

1. The temperatures and radiation values are based on nominal maximum design values. Localized adverse environments are addressed in the cable inspection program presented in Appendix B to this application.

3.1 REACTOR VESSEL, INTERNALS AND REACTOR COOLANT SYSTEM

3.1.1 Introduction

This section provides the results of the aging management reviews for components in the reactor vessel, internals and reactor coolant system that are subject to aging management review. The following component groups are addressed in this section (component group descriptions are available in the referenced sections).

- Reactor vessel and control element drive mechanism pressure boundary (Section 2.3.1.1)
- Reactor vessel internals (Section 2.3.1.2)
- Class 1 piping, valves, and reactor coolant pumps (Section 2.3.1.3)
- Pressurizer (Section 2.3.1.4)
- Steam generators (Section 2.3.1.5)

Table 3.1.1, Summary of Aging Management Programs for the Reactor Coolant System in Chapter IV of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the reactor coolant system (RCS) component groups. This table uses the format described in the introduction to Section 3. Hyperlinks to the program evaluations in Appendix B are provided.

3.1.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for the reactor vessel, internals and reactor coolant system components.

- Table 3.1.2-1 Reactor Vessel and CEDM Pressure Boundary — Summary of Aging Management Evaluation
- Table 3.1.2-2 Reactor Vessel Internals — Summary of Aging Management Evaluation
- Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps — Summary of Aging Management Evaluation
- Table 3.1.2-4 Pressurizer — Summary of Aging Management Evaluation
- Table 3.1.2-5 Steam Generators — Summary of Aging Management Evaluation

3.1.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the reactor coolant system components. Programs are described in Appendix B. Further details are provided in Tables 3.1.2-1 through 3.1.2-5.

3.1.2.1.1 Reactor Vessel and CEDM Pressure Boundary

Materials

Reactor vessel and CEDM pressure boundary components are constructed of the following materials.

- low alloy steel clad with stainless steel
- low alloy steel clad with nickel based alloy
- low alloy steel (bolting and lifting lugs)
- stainless steel
- nickel based alloy

Environment

Reactor vessel and CEDM pressure boundary components are exposed to the following environments.

- treated borated water
- air

The air environment, as applied to the reactor coolant system, is containment building atmosphere. This environment has the potential for leaking borated water and steam.

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel and CEDM pressure boundary components require management.

- cracking
- loss of material
- reduction in fracture toughness (reactor vessel beltline materials only)
- loss of mechanical closure integrity

The ANO-2 beltline region as defined for 32 extended full power years (EFPY) includes the lower shell and associated axial welds, intermediate shell and associated axial welds, intermediate shell to lower circumferential weld, and upper shell to intermediate shell circumferential weld. The limiting beltline material for 48 EFPY may be determined by comparing the fluence in the limiting upper shell region (i.e., RV nozzles) to the maximum fluence of the ANO Unit 2 power uprate weld and shell fluences. The maximum fluence at the inside wetted surface of the reactor vessel lower shell at 48 EFPY is 5.277E+19 n/cm^2 as discussed in Section 4.2. The estimated 48 EFPY peak fluence at the welds that connect the

RV nozzles to the nozzle shell is $3x10^{16}$ n/cm^2, which is below the threshold of $1x10^{17}$ n/cm^2 required for the material to be considered for surveillance testing. The nozzle welds are assumed to be identical to the welds in the intermediate shell plates, Linde 0091, and are not limiting with regard to radiation embrittlement due to the projected 48 EFPY fluence. Therefore, the beltline region as defined for 32 EFPY is identical to the beltline region for 48 EFPY. Reactor vessel items subject to reduction of fracture toughness include the lower shell and associated axial welds, and intermediate shell and associated axial welds, intermediate shell to lower circumferential weld, and upper shell to intermediate shell circumferential weld.

Aging Management Programs

The following programs manage the effects of aging on reactor vessel and CEDM pressure boundary components.

- reactor vessel integrity
- inservice inspection
- water chemistry control
- boric acid corrosion prevention
- alloy 600 aging management
- reactor vessel head penetration
- bolting and torquing activities

3.1.2.1.2 Reactor Vessel Internals

Materials

Reactor vessel internals components are constructed of the following materials.

- stainless steel
- cast austenitic stainless steel (CASS)

Environment

Reactor vessel internals components are exposed to the following environments.

- treated borated water

Aging Effects Requiring Management

The following aging effects associated with the reactor vessel internals components require management.

- cracking

- loss of material
- loss of mechanical closure integrity
- reduction in fracture toughness
- change in dimension

Aging Management Programs

The following programs manage the effects of aging on reactor vessel internals components.

- reactor vessel internals cast austenitic stainless steel components
- reactor vessel internals stainless steel plates, forgings, welds, and bolting
- water chemistry control
- inservice inspection

3.1.2.1.3 Class 1 Piping, Valves, and Reactor Coolant Pumps

Materials

Class 1 piping, valves, and reactor coolant pump components are constructed of the following materials.

- carbon steel clad with stainless steel
- stainless steel
- cast austenitic stainless steel (CASS)
- nickel based alloy
- carbon and low alloy steel (bolting)

Environment

Class 1 piping, valves, and reactor coolant pump components are exposed to the following environments.

- treated borated water
- air
- treated water

The treated water environment is present on the cooling water side of the reactor coolant pump thermal barrier heat exchanger.

Aging Effects Requiring Management

The following aging effects associated with the Class 1 piping, valves, and reactor coolant pump components require management.

- cracking
- reduction in fracture toughness
- loss of material
- loss of mechanical closure integrity
- fouling

Aging Management Programs

The following programs manage the effects of aging on Class 1 piping, valves, and reactor coolant pump components.

- water chemistry control
- inservice inspection
- cast austenitic stainless steel evaluation
- boric acid corrosion prevention
- alloy 600 aging management
- bolting and torquing activities

3.1.2.1.4 Pressurizer

Materials

Pressurizer components are constructed of the following materials.

- low alloy steel clad with stainless steel
- low alloy steel clad with nickel based alloy
- low alloy steel (manway cover and bolting)
- stainless steel
- nickel based alloy
- cast austenitic stainless steel (CASS) (surge line nozzle safe end)
- carbon steel (support skirt)

Environment

Pressurizer components are exposed to the following environments.

- treated borated water
- air

Aging Effects Requiring Management

The following aging effects associated with the pressurizer components require management.

- cracking
- loss of material
- reduction of fracture toughness
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on pressurizer components.

- water chemistry control
- pressurizer examinations
- inservice inspection
- boric acid corrosion prevention
- alloy 600 aging management
- bolting and torquing activities
- cast austenitic stainless steel evaluation

3.1.2.1.5 Steam Generators

Materials

Steam generator components are constructed of the following materials.

- low alloy steel clad with stainless steel
- low alloy steel clad with nickel based alloy
- low alloy steel
- carbon steel
- stainless steel
- nickel based alloy

Environment

Steam generator components are exposed to the following environments.

- treated borated water
- treated water
- air

The treated borated water is on the primary side of the steam generators. The treated water environment is on the secondary side of the steam generators. The secondary side treated water environment includes steam.

Aging Effects Requiring Management

The following aging effects associated with the steam generator components require management.

- cracking
- loss of material
- fouling
- loss of preload/mechanical closure integrity

Fouling is an aging effect for both sides of the steam generator tubes in the treated water environment.

Aging Management Programs

The following programs manage the effects of aging on steam generator components.

- water chemistry control
- inservice inspection
- boric acid corrosion prevention
- alloy 600 aging management
- bolting and torquing activities
- steam generator integrity
- flow-accelerated corrosion

3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant specific programs or that involve time limited aging analyses (TLAA). Section 3.1.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the ANO-2 approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.1.2.2.1 Cumulative Fatigue Damage (BWR/PWR)

Cracking due to fatigue is an aging effect applicable to reactor coolant system items subject to aging management review. Fatigue evaluations are TLAA since they are based on design transients (cyclic loadings) defined for the life of the plant. Fatigue evaluations were performed in the design of the ANO-2 Class 1 reactor coolant system components in accordance with the requirements specified in ASME Section III. The fatigue evaluations are contained in calculations and stress reports. Design cyclic loadings and thermal and pressure conditions for the reactor coolant system Class 1 components are defined by the component design specifications. The reactor coolant system design cyclic loadings are monitored through the fatigue monitoring program. The cumulative usage factors for the Class 1 components were determined to remain valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i). The complete evaluation of this TLAA is documented in Section 4.3.

3.1.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion (BWR/PWR)

1) NUREG-1801 refers to NRC Information Notice (IN) 90-04 and recommends augmented inspection to manage pitting and crevice corrosion. IN 90-04 states that if general corrosion pitting of the steam generator shell is known to exist the requirements of ASME Section XI may not be sufficient to differentiate isolated cracks for inherent geometric conditions. The concerns of IN 90-04 are not applicable to ANO-2 since the steam generators were replaced in 2000 and pitting corrosion of the steam generator shell is not known to currently exist. Therefore, ANO-2 credits the water chemistry control program and the inservice inspection program for managing loss of material due to pitting and crevice corrosion on the internal surfaces of the steam generator shell.

2) The discussion in this paragraph of NUREG-1800 is applicable to a BWR only.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement (BWR/PWR)

1) Neutron irradiation embrittlement is a TLAA to be evaluated for the period of license renewal for ferritic materials that have a neutron fluence of greater than 10^{17}n/cm2 (E >1 MeV) at the end of the license renewal term. The beltline region, as described in Section 3.1.2.1.1, was verified to be the limiting region in evaluating loss of fracture toughness due to neutron irradiation embrittlement. The TLAA is to evaluate the impact of neutron embrittlement

on (a) the RT_{PTS} value based on the requirements in 10CFR50.61, (b) the adjusted reference temperature, the plant's pressure temperature limits, (c) the Charpy upper shelf energy, and (d) the equivalent margins analyses performed in accordance with 10CFR50, Appendix G. Analysis has demonstrated that a Charpy upper-shelf energy of no less than 50 ft-lb will be maintained throughout the life of the vessel. Therefore, no equivalent margins analysis is required for ANO-2. This TLAA is required to be evaluated in accordance with 10CFR54.21(c)(1). The evaluation of this TLAA will be addressed in Section 4.2.

2) Loss of fracture toughness due to irradiation embrittlement of the reactor vessel beltline materials is managed by the reactor vessel integrity program at ANO-2. This program includes a plant-specific material surveillance program which monitors the effect of operational fluence levels on material specimens located in surveillance capsules located in the reactor vessel during power operations. Proposed unit-specific capsule withdrawal schedules are included as part of this program, which is detailed in Appendix B.

3) The ANO-2 reactor vessel internals do not include baffle/former bolts. The core shroud plates are joined in a welded configuration. The discussion in this paragraph of NUREG-1800 is not applicable to ANO-2.

3.1.2.2.4 Crack Initiation and Growth due to Thermal and Mechanical Loading or Stress Corrosion Cracking (BWR/PWR)

1) At ANO-2, the inservice inspection program and the water chemistry control program are credited to mitigate cracking of reactor coolant piping. In accordance with ASME Section XI, 1995 Edition, Examination Category B-J or B-F, small bore piping, defined as piping less than 4-inch nominal pipe schedule (NPS), does not receive volumetric inspection. However, ANO-2 has implemented a risk-informed methodology to select reactor coolant system piping welds for inspection in lieu of the requirements specified in the ASME Section XI. Therefore, the ANO-2 specific implementation of risk-informed inspection of reactor coolant system piping appropriately addresses cracking of piping greater than 1-inch NPS for the period of extended operation. ANO-2 RCS piping of 1-inch NPS and less is fabricated from austenitic stainless steel and is not within the scope of the risk-informed selection of piping welds for inspection. Since volumetric examination of this 1-inch piping is not practical, the most effective means to ensure its integrity is via conduction of a system leakage test. Consequently, since this piping is already subject to system leakage testing by the ASME Code, a risk assessment of this piping was not warranted. For further information regarding the inspection of small bore piping, see the inservice inspection program.

2) The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3) The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3.1.2.2.5 Crack Growth due to Cyclic Loading (PWR)

Intergranular separations (underclad cracking) in low alloy steel heat-affected zones under austenitic stainless steel weld claddings is applicable to components fabricated from SA 508, Class 2 forgings clad with a high heat input welding process. The ANO Unit 2 reactor vessel items fabricated from SA-508 Class 2 material include the primary nozzles, reactor vessel flange, and the closure head flange. NUREG-1801 identifies this aging effect for reactor vessel items fabricated from SA-508, Class 2 materials exposed to a neutron fluence > 10^{17} n/cm^2. The fluence at the end of the period of extended operation at the bottom of the nozzle to shell welds (highest fluence received by an SA-508 Class 2 ANO-2 item) has been determined to be less than this limit, approximately 2.3E10^{16} n/cm^2. In addition, controls on the cladding chemical composition and processes during fabrication of the ANO-2 reactor vessel reduced the potential for cracking of the vessel cladding. There have been no cases of underclad cracking in any clad Combustion Engineering reactor vessel subcomponents. Therefore, this aging effect does not require management for the period of extended operation for ANO-2.

3.1.2.2.6 Changes in Dimension due to Void Swelling (PWR)

The visual inspections of the reactor vessel internals completed as part of the inservice inspection program according to ASME Section XI, Examination Category B-N-3, are not sufficient to detect changes in dimension due to void swelling. Therefore, void swelling of reactor vessel internals is managed by the reactor vessel internals CASS and reactor vessel internals stainless steel programs. The examinations described in the reactor vessel internals program may be supplemented to incorporate requirements for dimensional verification of critical reactor vessel internals. Further understanding of this aging effect through industry programs will provide additional bases for the inspections under this program.

3.1.2.2.7 Crack Initiation and Growth due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking (PWR)

1) This grouping includes the surge nozzle thermal sleeve, safety injection nozzle thermal sleeve, charging inlet nozzle thermal sleeve, RTD nozzles, pressure measurement nozzle, sampling nozzle, and partial nozzle replacement. Reactor vessel items included in this grouping are the lower shell and bottom head cladding, surveillance capsule holders, core stabilizing lugs, core stop and support lugs, and the flow baffle and skirt. Steam

generator items included in this grouping are the tube plate cladding, channel head divider plate, and primary nozzle closure rings. Refer to item 3.1.1-44 of Table 3.1.1 for primary side steam generator items. Cracking of nickel based alloy components due to primary water stress corrosion cracking (PWSCC) is managed by the alloy 600 aging management program supplemented by the water chemistry control program and the inservice inspection program. Additionally, EPRI Material Reliability Program (MRP) in conjunction with the PWR owners groups is developing a strategic plan to manage and mitigate cracking of nickel based alloy items. The guidance developed by the MRP will be used to identify critical locations for inspection and to augment existing ISI inspections at ANO-2, as appropriate. Since RCS pressure control using the pressurizer sprays is not an intended function of the pressurizer, the pressurizer spray assembly is not subject to aging management for ANO-2.

2) At ANO-2, the surge line piping and fittings are fabricated of cast austenitic stainless steel (CASS). Crack initiation and growth due to stress corrosion cracking in this piping is managed by the water chemistry control program and the inservice inspection program.

3) Nickel based alloy material is identified for the pressurizer instrumentation nozzles, heater sheaths and sleeves, and thermal sleeves. ANO-2 pressurizer components included in this grouping are the instrument nozzles, X-1 and T-4 heater penetration nozzles and plugs, original heater sheath, heater sleeve, and end plugs are also grouped here. The programs credited for the management of PWSCC of these nickel based alloy items are the alloy 600 aging management program and water chemistry control program, supplemented by the inservice inspection program. As described in item 1 above, the alloy 600 aging management program includes participation in industry programs to identify critical locations for inspection and augment existing ISI inspections at ANO-2 where appropriate.

3.1.2.2.8 Crack Initiation and Growth due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking (PWR)

The ANO-2 reactor vessel internals do not include baffle / former bolts. The core shroud plates are joined in a welded configuration. The discussion in this paragraph of NUREG-1800 is not applicable to ANO-2.

3.1.2.2.9 Loss of Preload due to Stress Relaxation (PWR)

The ANO-2 reactor vessel internals do not include baffle / former bolts. The core shroud plates are joined in a welded configuration. The discussion in this paragraph of NUREG-1800 is not applicable to ANO-2.

3.1.2.2.10 Loss of Section Thickness due to Erosion (PWR)

The ANO-2 steam generators do not include impingement plates. Therefore, the discussion in this paragraph is not applicable.

3.1.2.2.11 Crack Initiation and Growth due to PWSCC, ODSCC, or Intergranular Attack or Loss of Material due to Wastage and Pitting Corrosion or Loss of Section Thickness due to Fretting and Wear or Denting due to Corrosion of Carbon Steel Tube Support Plate (PWR)

Crack initiation and growth due to PWSCC, SCC, or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in nickel based alloy components of the steam generator tubes and plugs. To manage these aging effects, ANO-2 credits the steam generator integrity program supplemented by the water chemistry control program and the inservice inspection program. The steam generator integrity program assessment of tube integrity and plugging or repair criteria of flawed tubes is in accordance with the plant technical specifications and NEI 97-06 guidelines. For general and pitting corrosion, the acceptance criteria are in accordance with NEI 97-06 guidelines.

3.1.2.2.12 Loss of Section Thickness due to Flow-accelerated Corrosion

The ANO-2 steam generators do not include carbon steel tube support lattice bars. Therefore, loss of section thickness of these bars it not an applicable aging effect for ANO-2.

3.1.2.2.13 Ligament Cracking due to Corrosion (PWR)

The ANO-2 steam generators have stainless steel tube support plates. Therefore, ligament cracking due to corrosion is not an applicable aging effect for ANO-2.

3.1.2.2.14 Loss of Material due to Flow-Accelerated Corrosion (PWR)

The discussion in this paragraph of NUREG-1800 is applicable to CE System 80 steam generators only, whereas ANO-2 has Westinghouse Delta 109 steam generators.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 corrective action program. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing ANO document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.1.2.3 Time-Limited Aging Analyses

TLAA identified for the reactor coolant system include reactor vessel neutron embrittlement, metal fatigue, flaw growth acceptance evaluations, leak before break, steam generator flow induced vibration analyses, high energy line break postulations, and reactor vessel beltline fracture toughness evaluations. These topics are addressed in Section 4.

3.1.3 <u>Conclusion</u>

The reactor vessel, internals and reactor coolant system components (as well as secondary side steam generator portions) that are subject to aging management review have been identified in accordance with the requirements of 10CFR54.21. The aging management programs selected to manage aging effects for the reactor vessel, internals and reactor coolant system components (and secondary side steam generator portions) are identified in the following tables.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the reactor coolant system components will be managed such there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.1.1
Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-1	Reactor coolant pressure boundary components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Cracking due to fatigue is an aging effect applicable to reactor coolant pressure boundary items subject to aging management review. Because of the uniform applicability of this effect, the effect and the comparison to the associated NUREG-1801 line items have not been listed in the Class 1 tables (3.1.2-1 through 3.1.2-5) below. The metal fatigue TLAA associated with Class 1 components is addressed in Section 4.3.
3.1.1-2	Steam generator shell assembly	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Yes, detection of aging effects is to be further evaluated	This grouping includes the steam generator shell assembly and attached components, and components of the secondary side internals. The concerns of IN 90-04 are not applicable to ANO-2 since the steam generators were replaced in 2000 and pitting corrosion of the steam generator shell is not known to currently exist. ANO-2 credits the water chemistry control program and the inservice inspection program for managing loss of material due to pitting and crevice corrosion on the internal surfaces of the steam generator shell. For further evaluation, see Section 3.1.2.2.2. Inservice inspection is a plant-specific program for ANO-2.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-3	BWR only				
3.1.1-4	Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E>1 MeV)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	Yes, TLAA	Evaluation of these TLAA is addressed in Section 4.2. For further evaluation, see Section 3.1.2.2.3
3.1.1-5	Reactor vessel beltline shell and welds	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Yes, plant specific	Consistent with NUREG-1801. The reactor vessel integrity program will manage the reduction of fracture toughness of reactor vessel beltline materials. For further evaluation, see Section 3.1.2.2.3
3.1.1-6	Westinghouse and Babcock & Wilcox (B&W) baffle/ former bolts	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific	Yes, plant specific	The ANO-2 reactor vessel internals do not include baffle / former bolts. The core shroud plates are joined in a welded configuration.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-7	Small-bore reactor coolant system and connected systems piping	Crack initiation and growth due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), and thermal and mechanical Loading	Inservice inspection; water chemistry; one-time inspection	Yes, parameters monitored/ inspected and detection of aging effects are to be further evaluated	ANO-2 has implemented a risk-informed methodology to select RCS piping welds for inspection in lieu of the requirements specified in ASME Section XI. Therefore, the current inspection methods as detailed in the inservice inspection program supplemented by the water chemistry control program will manage cracking of small bore piping systems. For further evaluation, see Section 3.1.2.2.4. Inservice inspection is a plant-specific program for ANO-2.
3.1.1-8	BWR only				
3.1.1-9	BWR only				
3.1.1-10	Vessel shell	Crack growth due to cyclic loading	TLAA	Yes, TLAA	As described in Section 3.1.2.2.5, the ANO-2 reactor vessel items fabricated of the subject material are not susceptible to this aging effect.
3.1.1-11	Reactor internals	Changes in dimension due to void swelling	Plant specific	Yes, plant specific	Consistent with NUREG-1801. Void swelling of reactor vessel internals is managed by the RV internals CASS and RV internals SS programs. For further evaluation, see Section 3.1.2.2.6.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-12	PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific	Yes, plant specific	For further discussion of this item, and the components included refer to Section 3.1.2.2.7. The water chemistry control program is credited for managing cracking due to SCC/IGA. The alloy 600 aging management program manages PWSCC of nickel based alloys as a supplement to water chemistry control. Furthermore, the inservice inspection program supplements water chemistry control to manage cracking at welded connections.
3.1.1-13	Cast austenitic stainless steel (CASS) reactor coolant system piping	Crack initiation and growth due to SCC	Plant specific	Yes, plant specific	The credited programs are the water chemistry control program and the inservice inspection program. For further discussion of this item, refer to Section 3.1.2.2.7.
3.1.1-14	Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated	For further discussion of this item, and the components included refer to Section 3.1.2.2.7. The alloy 600 aging management program and water chemistry control program are credited for managing the aging effects for the nickel based alloy components, supplemented by the inservice inspection program for the components within the scope of the inservice inspection program. Inservice inspection is a plant-specific program for ANO-2.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-15	Westinghouse and B&W baffle former bolts	Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC)	Plant specific	Yes, plant specific	The ANO-2 reactor vessel internals do not include baffle / former bolts. The core shroud plates are joined in a welded configuration.
3.1.1-16	Westinghouse and B&W baffle former bolts	Loss of preload due to stress relaxation	Plant specific	Yes, plant specific	The ANO-2 reactor vessel internals do not include baffle / former bolts. The core shroud plates are joined in a welded configuration.
3.1.1-17	Steam generator feedwater impingement plate and support	Loss of section thickness due to erosion	Plant specific	Yes, plant specific	Steam generators at ANO-2 do not include impingement plates.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-18	(Alloy 600) Steam generator tubes, repair sleeves, and plugs	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA); or Loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Yes, effectiveness of a proposed AMP is to be evaluated	Consistent with NUREG-1801. The steam generator integrity program, based on NEI 97-06, in conjunction with the water chemistry control program will manage the identified aging effects. For further evaluation, see Section 3.1.2.2.11.
3.1.1-19	Tube support lattice bars made of carbon steel	Loss of section thickness due to flow-accelerated corrosion (FAC)	Plant specific	Yes, plant specific	The ANO-2 steam generators do not include carbon steel tube support lattice bars.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-20	Carbon steel tube support plate	Ligament cracking due to corrosion	Plant specific	Yes, effectiveness of a proposed AMP is to be evaluated	Not applicable. The ANO-2 steam generators do not have carbon steel tube support plates.
3.1.1-21	Steam generator feedwater inlet ring and supports	Loss of material due to flow accelerated corrosion	Combustion Engineering (CE) steam generator feedwater ring inspection	Yes, plant specific	This NUREG-1801 grouping is applicable to Combustion Engineering (CE) System 80 steam generators. As such, this NUREG-1801 item is not applicable to ANO-2, which has Westinghouse Delta 109 steam generators.
3.1.1-22	Reactor vessel closure studs and stud assembly	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	No	The inservice inspection program will manage cracking of the reactor vessel closure bolting.
3.1.1-23	CASS pump casing and valve body	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	No	This grouping includes valve bodies and the reactor coolant pump casing and cover that are formed of CASS material. The inservice inspection program will manage this aging effect. Inservice inspection is a plant-specific program for ANO-2.
3.1.1-24	CASS piping	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	Consistent with NUREG-1801. The CASS evaluation program, supplemented by the inservice inspection program, is credited with managing this aging effect for CASS piping (surge line).

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-25	BWR piping and fittings; steam generator components	Wall thinning due to flow accelerated corrosion	Flow accelerated corrosion	No	Consistent with NUREG-1801. The flow-accelerated corrosion program supplemented by the water chemistry control program will manage this aging effect for the susceptible items.
3.1.1-26	Reactor coolant Pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high-pressure and high-temperature systems	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	No	Reactor vessel closure bolting is addressed separately in Item 3.1.1-22 and Item 3.1.1-47 of this table. For primary side Class 1 closures, cracking (SCC) of bolts is managed by the inservice inspection program. Loss of mechanical closure integrity is managed by the combination of the bolting and torquing activities and inservice inspection program for both reactor coolant pressure boundary Class 1 closures and secondary side steam generator closures.
3.1.1-27	BWR only				
3.1.1-28	BWR only				
3.1.1-29	BWR only				
3.1.1-30	BWR only				
3.1.1-31	BWR only				
3.1.1-32	BWR only				
3.1.1-33	BWR only				

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-34	BWR only				
3.1.1-35	CRD nozzle	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	No	The combination of the inservice inspection program, water chemistry control program and the reactor vessel head penetration program manage cracking of the nickel-based CEDM nozzle and welds, as well as the vessel vent line nozzle.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-36	Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting)	Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC	Inservice inspection; water chemistry	No	This grouping includes stainless steel and nickel based alloy portions (including cladding) of the pressurizer, reactor vessel, reactor coolant pumps, and piping and valves. NUREG-1801 excludes CASS material from this grouping. However, the grouping includes NUREG-1801 Volume 2 item numbers specific to CASS valve bodies and pump casings. ANO-2 includes CASS valve bodies, pump casings, and closure flanges in this group. The inservice inspection program supplements the water chemistry control program for management of cracking (SSC/IGA) of applicable portions of this grouping that are included in the inservice inspection program. Inservice inspection is a plant-specific program for ANO-2. In addition to the NUREG-1801 identified programs, the alloy 600 aging management program manages PWSCC of nickel alloys, supplemented by the water chemistry control program, for the reactor vessel shell cladding and system nozzle/safe end welds. Similarly, the water chemistry control and inservice inspection programs are further supplemented by the pressurizer examinations for cracking of the pressurizer cladding.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-37	Reactor vessel internals CASS components	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement	No	Consistent with NUREG-1801. The RV internals CASS program will manage the aging effects for the CASS portions of the internals. The RV internals CASS program includes provisions for CASS items consistent with the NUREG-1801 thermal aging and neutron irradiation embrittlement program.
3.1.1-38	External surfaces of carbon steel components in reactor coolant system pressure boundary	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. ANO-2 credits the boric acid corrosion prevention program for the management of loss of material due to boric acid corrosion.
3.1.1-39	Steam generator secondary manways and handholds (carbon steel)	Loss of material due to erosion	Inservice inspection	No	This NUREG-1801 grouping, which addresses erosion concerns in once-through steam generators, is not applicable to ANO-2.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-40	Reactor internals, reactor vessel closure studs, and core support pads	Loss of material due to wear	Inservice inspection	No	Wear of the reactor vessel internals components (dowel pins, guide lug inserts, holddown ring, CEA and CSB pins, CSB alignment keys, and lower internals insert pins), the reactor vessel closure flanges, and core stabilizing lugs is managed by the inservice inspection program. Inservice inspection is a plant-specific program for ANO-2. Reactor vessel closure stud aging effects / mechanisms are addressed in items Item 3.1.1-22 and Item 3.1.1-47 of this table.
3.1.1-41	Pressurizer integral support	Crack initiation and growth due to cyclic loading	Inservice inspection	No	ANO-2 credits the inservice inspection program for management of cracking due to flaw growth (e.g. cyclic loading) at the interface between the pressurizer shell and integral support flange. Inservice inspection is a plant-specific program for ANO-2.
3.1.1-42	Upper and lower internals assembly (Westinghouse)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring	No	Loss of preload of the reactor vessel internals is managed by the RV internals SS program supplemented by the inservice inspection program for components within the scope of the inservice inspection program. Inservice inspection is a plant-specific program for ANO-2. In the component specific tables, loss of mechanical closure integrity is equivalent to loss of preload.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-43	Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle former bolts)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	PWR vessel internals; water chemistry	No	For components that reference this line item, loss of fracture toughness and void swelling of the reactor vessel internals is managed by the RV internals SS program.
3.1.1-44	Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends	Crack initiation and growth due to SCC, PWSCC, and/or IASCC	Inservice inspection; water chemistry	No	The water chemistry control program will manage cracking due to SCC. In the primary water environment, the alloy 600 aging management program manages PWSCC of nickel alloys supplemented by the water chemistry control program. The inservice inspection program also supplements the water chemistry control program for components in this grouping. Inservice inspection is a plant-specific program for ANO-2. Tubesheets are not listed in NUREG-1801, Volume 2.
3.1.1-45	Vessel internals (except Westinghouse and B&W baffle former bolts	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	No	Consistent with NUREG-1801. Crack initiation and growth in the reactor vessel internals is managed by the RV internals CASS and RV internals SS programs supplemented by the inservice inspection program and water chemistry control program.

Table 3.1.1: Reactor Coolant System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.1.1-46	Reactor internals (B&W screws and bolts)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	ANO-2 utilizes Combustion Engineering designed reactor vessel internals. Therefore, this NUREG-1801 grouping is not applicable.
3.1.1-47	Reactor vessel closure studs and stud assembly	Loss of material due to wear	Reactor head closure studs	No	The inservice inspection program will manage loss of material due to wear of the reactor vessel closure bolting.
3.1.1-48	Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	No	Loss of preload of the reactor vessel internals will be managed by the RV internals SS program supplemented by the inservice inspection program. Inservice inspection is a plant-specific program for ANO-2.

<u>Notes for Tables 3.1.2-1 through 3.1.2-5</u>

<u>Generic notes</u>

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 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.

<u>Plant-specific notes</u>

101. The material and environment combination is in NUREG-1801 but neither the plant component, nor a reasonable substitute, exists.

102. Certain welds are fabricated of nickel based weld material (Alloy 82/182, 52/152). PWSCC is a concern for these welds.

103. The RV beltline region definition does not need to be expanded for license renewal to include the nozzle belt region for ANO-2.

104. Material is identified as CASS (SA351 Grade CF-8 or CF-8M). The NUREG-1801 AMP discussion credits either primary water chemistry or material selection according to NUREG-0313 Rev. 2 guidelines for carbon and ferrite limits to manage SCC. ANO-2 credits the water chemistry control program for managing cracking due to SCC and IGA. The inservice inspection program supplements the water chemistry control program for management of cracking and flaw growth.

105. Focus of the credited steam generator integrity program is on maintaining the integrity of the steam generator tubes which additionally serves to supplement the water chemistry control program for management of cracking and loss of material of pertinent secondary side components, including internal supports.

106. The flow-accelerated corrosion program will be supplemented by the water chemistry control program for the management of loss of material of this component. ANO-2 will explicitly credit both programs to meet the attributes of the recommended NUREG-1801 program.

107. The reactor vessel internals program and the water chemistry control program will be supplemented by the inservice inspection program for the management of cracking of this component. The combination of the reactor vessel internals program and the water chemistry control program meet the requirements of the recommended NUREG-1801 XI.M16 and XI.M2 programs for managing this aging effect.

108. The RV head penetration program and the water chemistry control program will be supplemented by the inservice inspection program for the management of cracking of this component. The combination of the RV head penetration program and the water chemistry control program meet the requirements of the recommended NUREG-1801 XI.M11 and XI.M2 programs.

Table 3.1.2-1
Reactor Vessel and CEDM Pressure Boundaries
Summary of Aging Management

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Interior and Exterior Attachments								
Closure head lifting lugs	SSR	Low alloy steel	Air (external)	Cracking (fatigue)	TLAA-metal fatigue	IV.A2.8-a	3.1.1-1	D
				Loss of material	Boric acid corrosion prevention	IV.A2.8-b	3.1.1-38	C
					Inservice inspection			101
					System walkdown			101
Closure studs, nuts, and washers	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection	IV.A2.1-c	3.1.1-22	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.1-e	3.1.1-1	B
				Loss of material	Boric acid corrosion prevention	IV.A2.1-a	3.1.1-38	A
					Inservice inspection	IV.A2.1-d	3.1.1-47	E
				Loss of mechanical closure integrity	Bolting and torquing activities			H
					Inservice inspection			H

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Core stabilizing lugs	Core support	Nickel based alloy	Treated borated water (internal)	Cracking	Water chemistry control	IV.A2.6-a	3.1.1-12	A
					Inservice inspection	IV.A2.6-a	3.1.1-12	E
					Alloy 600 aging management	IV.A2.6-a	3.1.1-12	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Loss of material	Inservice inspection	IV.B3.5-e	3.1.1-40	E
					Water chemistry control			H
Core stop lugs Flow skirt	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Cracking	Water chemistry control	IV.A2.6-a	3.1.1-12	C
					Inservice inspection	IV.A2.6-a	3.1.1-12	E
					Alloy 600 aging management	IV.A2.6-a	3.1.1-12	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Loss of material	Water chemistry control			101

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Grayloc clamp	Pressure boundary	Stainless steel	Air (external)	Cracking (fatigue)	TLAA-metal fatigue			101
				Loss of mechanical closure integrity	Bolting and torquing activities			101
Grayloc clamp studs Grayloc clamp nuts	Pressure boundary	Low alloy steel	Air (external)	Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Loss of material	Boric acid corrosion prevention	IV.C2.4-f	3.1.1-38	C
					Inservice inspection			101
				Loss of mechanical closure integrity	Bolting and torquing activities	IV.C2.4-g	3.1.1-26	E

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
ICI drive nuts ICI spacer sleeves	Pressure boundary	Stainless steel	Air (external)	Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Loss of mechanical closure integrity	Bolting and torquing activities	IV.C2.4-g	3.1.1-26	E
Reactor vessel support pads Shear lugs	SSR	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.8-b	3.1.1-38	C
					Inservice inspection			101
					System walkdown			101
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.8-a	3.1.1-1	E
				Cracking	Inservice inspection			101
Surveillance capsule holders	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.A2.6-a	3.1.1-12	C
					Inservice inspection	IV.A2.6-a	3.1.1-12	E
					Alloy 600 aging management	IV.A2.6-a	3.1.1-12	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetrations								
CEDM motor housing CEDM upper pressure housing CEDM ball seal housing CEDM upper pressure housing upper fitting	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.A2.2-b	3.1.1-36	A
					Inservice inspection	IV.A2.2-b	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.2-c	3.1.1-1	B
CEDM motor housing upper and lower end fittings CEDM upper pressure housing lower fitting	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Water chemistry control	IV.A2.2-a	3.1.1-35	C
					Alloy 600 aging management	IV.A2.2-a	3.1.1-35	E
					Inservice inspection	IV.A2.2-a	3.1.1-35	E
				Cracking (fatigue)	TLAA-metal fatigue			F

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
CEDM nozzle ICI nozzle tubes	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.A2.2-a IV.A2.7-b	3.1.1-35	A, 108
					Inservice inspection	IV.A2.2-a IV.A2.7-b	3.1.1-35	E, 108
					Reactor vessel head penetration	IV.A2.2-a IV.A2.7-b	3.1.1-35	A, 108
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.2-c	3.1.1-1	B, D
CEDM steel ball	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
					Inservice inspection			101
ICI flange adapter/ seal plate	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.A2.4-b	3.1.1-36	C
					Inservice inspection	IV.A2.4-b	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.2-c	3.1.1-1	D

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor vessel vent pipe	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.A2.7-b	3.1.1-35	A, 108
					Inservice inspection	IV.A2.7-b	3.1.1-35	E, 108
					Reactor vessel head penetration	IV.A2.7-b	3.1.1-35	A, 108
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	D
Reactor vessel vent pipe flange	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.1-g	3.1.1-36	A
					Inservice inspection	IV.C2.1-g	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	D

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Reactor Vessel Shell and Nozzles								
Bottom head (torus and dome) Upper shell	Pressure boundary	Low alloy steel clad with stainless steel and nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
					Alloy 600 aging management (bottom head cladding)	IV.C2.5-k	3.1.1-12	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.5-d	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.1-a	3.1.1-38	C
					System walkdown			H

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Closure head dome (torus and dome)	Pressure boundary	Low alloy steel clad with stainless steel and nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.1-b	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.1-a	3.1.1-38	A
					System walkdown			H
Closure head flange	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			F
					Inservice inspection	IV.A2.5-f	3.1.1-40	E
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.5-d	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.5-e	3.1.1-38	C
					System walkdown			F

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Intermediate shell Lower shell	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.5-d	3.1.1-1	B
				Reduction in fracture toughness	Reactor vessel integrity	IV.A2.5-c	3.1.1-5	A, 103
					TLAA-reactor vessel neutron embrittlement	IV.A2.5-a	3.1.1-4	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.5-e	3.1.1-38	C
					System walkdown			H

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary inlet nozzles Primary outlet nozzles	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
					Inservice inspection	IV.A2.5-f	3.1.1-40	E
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.3-c	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.5-e	3.1.1-38	C
					System walkdown			H
Primary inlet nozzle safe ends Primary outlet nozzle safe ends	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.3-c	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.1-a	3.1.1-38	C
					System walkdown			F

Table 3.1.2-1: Reactor Vessel and CEDM Pressure Boundary (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Vessel flange	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
					Inservice inspection	IV.A2.5-f	3.1.1-40	E
				Cracking	Water chemistry control	IV.C2.5-c	3.1.1-36	C
					Inservice inspection	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.A2.5-d	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.A2.5-e	3.1.1-38	A
					System walkdown			H

Table 3.1.2-2
Reactor Vessel Internals (Combustion)
Summary of Aging Management

Table 3.1.2-2 Reactor Vessel Internals								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Control Element Assembly Shroud Assembly								
CEA instrument tube CEA shroud adapter CEA shroud support Positioning plate	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.2-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.2-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.2-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	B
				Change in dimension	RV internals SS	IV.B3.2-c	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
- CEA shroud extension shaft guides, cylinders, and bases - CEA shroud base - CEA shroud flow channel - CEA shroud flow channel cap - CEA shroud shaft retention pin - CEA shroud retention block - External spanner nut - Internal spanner nut - CEA shroud fasteners	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
					Inservice inspection	IV.B3.2-d	3.1.1-40	E
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.2-a IV.B3.2-b	3.1.1-45	E, 107
					Water chemistry control	IV.B3.2-a IV.B3.2-b	3.1.1-45	A, 107
					RV internals SS	IV.B3.2-a IV.B3.2-b	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	B

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
- CEA shroud extension shaft guides, cylinders, and bases - CEA shroud base - CEA shroud flow channel - CEA shroud flow channel cap - CEA shroud shaft retention pin - CEA shroud retention block - External spanner nut - Internal spanner nut - CEA shroud fasteners (continued)	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Change in dimension	RV internals SS	IV.B3.2-c	3.1.1-11	A
				Loss of mechanical closure integrity (fasteners)	Inservice inspection	IV.B3.2-g	3.1.1-48	E
					RV internals SS	IV.B3.2-g	3.1.1-48	E

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
CEA shroud flow channel extension	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.2-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.2-a	3.1.1-45	C, 107
					RV internals SS	IV.B3.2-a	3.1.1-45	C, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.2-c	3.1.1-11	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
CEA shroud tube	CS, CEAS, FD, INS	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	RV internals CASS	IV.B3.2-e	3.1.1-37	E
				Cracking	Inservice inspection	IV.B3.2-a	3.1.1-45	E,107
					Water chemistry control	IV.B3.2-a	3.1.1-45	A, 107
					RV internals CASS	IV.B3.2-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	B
				Change in dimension	RV internals CASS	IV.B3.2-c	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud Assembly								
Core shroud plates Plates Ribs Intermediate plates Core shroud guide lugs	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.4-c	3.1.1-43	A
				Cracking	Inservice inspection	IV.B3.4-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.4-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.4-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.4-d	3.1.1-1	B
				Change in dimension	RV internals SS	IV.B3.4-b	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Core Support Barrel (CSB) Assembly								
CSB alignment keys	CS, CEAS, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.3-b	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.3-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.3-a	3.1.1-45	C, 107
					RV internals SS	IV.B3.3-a	3.1.1-45	C, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.3-b	3.1.1-11	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
CSB assembly dowel pin CSB lifting bolt insert CSB lower flange CSB lug CSB nozzle	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.3-b	3.1.1-40	E
					Water chemistry control			101
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.3-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.3-a	3.1.1-45	C, 107
					RV internals SS	IV.B3.3-a	3.1.1-45	C, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.3-b	3.1.1-11	C
CSB cylinder CSB upper flange	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.3-b	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
CSB cylinder CSB upper flange (continued)	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Cracking	Inservice inspection	IV.B3.3-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.3-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.3-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.3-b	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Incore Instrumentation (ICI)								
Guide tubes ICI thimble support plate assembly ICI support plate, grid, lifting support, lifting plate, column, plates, funnel Pad, ring, nipple, hex bolt, spacer Threaded rod, hex jam nut, thimble support nut, cap screws	FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.1-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.1-a	3.1.1-45	C, 107
					RV internals SS	IV.B3.1-a	3.1.1-45	C, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Loss of mechanical closure integrity	Inservice inspection	IV.B3.2-g	3.1.1-42	E
					RV internals SS	IV.B3.2-g	3.1.1-42	E
				Change in dimension	RV internals SS	IV.B3.1-b	3.1.1-11	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Lower Internals Assembly								
Bottom plate Bottom plate manhole cover Cylinder	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.5-e	3.1.1-40	E
					Water chemistry control			101
				Reduction in fracture toughness	RV internals SS	IV.B3.5-d	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.5-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.5-a	3.1.1-45	C, 107
					RV internals SS	IV.B3.5-a	3.1.1-45	C, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.5-g	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.5-c	3.1.1-11	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Core support column Core support plate Insert pins Support beam Support beam flange	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.5-e	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.5-d	3.1.1-43	A
				Cracking	Inservice inspection	IV.B3.5-a IV.B3.5-b	3.1.1-45	E, 107
					Water chemistry control	IV.B3.5-a IV.B3.5-b	3.1.1-45	A, 107
					RV internals SS	IV.B3.5-a IV.B3.5-b	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.5-g	3.1.1-1	B
				Change in dimension	RV internals SS	IV.B3.5-c	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Upper Internals Assembly								
Fuel assembly alignment plate (FAP) FAP guide lug inserts	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.1-c	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.1-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.1-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.1-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.1-b	3.1.1-11	A

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Holddown ring	CS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.1-c	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C
				Cracking	Inservice inspection	IV.B3.1-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.1-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.1-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Loss of mechanical closure integrity	Inservice inspection	IV.B3.4-h	3.1.1-42	E
					RV internals SS	IV.B3.4-h	3.1.1-42	E
				Change in dimension	RV internals SS	IV.B3.1-b	3.1.1-11	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Upper guide structure (UGS) support plate UGS cylinder UGS grid plate UGS flange UGS sleeve UGS lifting bolt insert UGS alignment keys UGS dowel pins	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Loss of material	Inservice inspection	IV.B3.1-c	3.1.1-40	E
					Water chemistry control			H
				Reduction in fracture toughness	RV internals SS	IV.B3.3-a	3.1.1-43	C

Table 3.1.2-2 Reactor Vessel Internals (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Upper guide structure (UGS) support plate UGS cylinder UGS grid plate UGS flange UGS sleeve UGS lifting bolt insert UGS alignment keys UGS dowel pins (continued)	CS, CEAS, FD, INS	Stainless steel	Treated borated water (internal)	Cracking	Inservice inspection	IV.B3.1-a	3.1.1-45	E, 107
					Water chemistry control	IV.B3.1-a	3.1.1-45	A, 107
					RV internals SS	IV.B3.1-a	3.1.1-45	A, 107
				Cracking (fatigue)	TLAA-metal fatigue	IV.B3.2-f	3.1.1-1	D
				Change in dimension	RV internals SS	IV.B3.1-b	3.1.1-11	A

Table 3.1.2-3
Class 1 Piping, Valves, and Reactor Coolant Pumps
Summary of Aging Management

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Charging inlet nozzle Safety injection nozzle Surge line nozzle	Pressure boundary	Carbon steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Inservice inspection	IV.C2.1-c	3.1.1-36	E, 102
					Water chemistry control	IV.C2.1-c	3.1.1-36	C, 102
					Alloy 600 aging management (welds)	IV.C2.5-k	3.1.1-14	C, 102
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.1-a	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.2-d	3.1.1-38	C
					System walkdown			F

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Charging inlet nozzle safe end Drain nozzle safe ends Letdown nozzle safe ends Pressure measurement nozzle safe end Sampling nozzle safe end	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	A
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-c	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Charging inlet nozzle thermal sleeve Safety injection nozzle thermal sleeve Surge line thermal sleeve	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Alloy 600 aging management	IV.C2.5-k	3.1.1-12	C
					Water chemistry control	IV.C2.5-k	3.1.1-12	C
					Inservice inspection	IV.C2.5-k	3.1.1-12	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	D
Class 1 boundary orifices	Pressure boundary Flow control	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	C
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-a	3.1.1-1	D

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 pipe and fittings NPS less than 4”	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.1-g IV.C2.2-h	3.1.1-7	E
					Water chemistry control	IV.C2.1-g IV.C2.2-h	3.1.1-7	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-a IV.C2.2-b	3.1.1-1	B
Class 1 pipe 4” ≥ NPS	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f IV.C2.1-c	3.1.1-36	A
					Inservice inspection	IV.C2.2-f IV.C2.1-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-a	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 fittings	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f IV.C2.1-c	3.1.1-36	A
					Inservice inspection	IV.C2.2-f IV.C2.1-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-a	3.1.1-1	B
Cold leg piping and elbows Hot leg pipe and elbows	Pressure boundary	Carbon steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.1-c	3.1.1-36	E
					Water chemistry control	IV.C2.1-c	3.1.1-36	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.1-a	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.1-d	3.1.1-38	A
					System walkdown			H

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Drain nozzles Letdown nozzles Shutdown cooling outlet nozzle Spray nozzle	Pressure boundary	Carbon steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Water chemistry control	IV.C2.1-c	3.1.1-36	C, 102
					Inservice inspection	IV.C2.1-c	3.1.1-36	E, 102
					Alloy 600 aging management (welds)	IV.C2.5-k	3.1.1-14	E, 102
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.2-d	3.1.1-38	C
					System walkdown			F

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pressure measurement nozzle Replacement pressure nozzle Sampling nozzle	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Alloy 600 aging management	IV.C2.5-s	3.1.1-12	C
					Water chemistry control	IV.C2.5-s	3.1.1-12	C
				Cracking (fatigue)	TLAA-metal fatigue			F

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
RCP safe ends	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	CASS evaluation	IV.C2.2-e	3.1.1-24	A
					Inservice inspection	IV.C2.2-e	3.1.1-24	E
				Cracking	Inservice inspection	IV.C2.2-g	3.1.1-13	E, 102, 104
					Water chemistry control	IV.C2.2-g	3.1.1-13	A, 102, 104
					Alloy 600 aging management (welds)	IV.C2.5-k	3.1.1-14	C, 102, 104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-c	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
RTD nozzles	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Alloy 600 aging management	IV.C2.5-s	3.1.1-12	C
					Water chemistry control	IV.C2.5-s	3.1.1-12	C
					Inservice inspection	IV.C2.5-s	3.1.1-12	E
				Cracking (fatigue)	TLAA-metal fatigue			F

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Safety injection nozzle safe end Shutdown cooling outlet nozzle safe end Surge nozzle safe end	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	CASS evaluation	IV.C2.2-e	3.1.1-24	A
				Cracking	Water chemistry control	IV.C2.2-g	3.1.1-13	A, 104
					Inservice inspection	IV.C2.2-g	3.1.1-13	E, 104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-c	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Stainless steel bolting	Pressure boundary	Stainless steel	Air (external)	Cracking	Inservice inspection	IV.C2.4-e	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Reduction in fracture toughness (17-4PH material only)	Inservice inspection			101
				Loss of mechanical closure integrity	Inservice inspection Bolting and torquing activities	IV.C2.4-g	3.1.1-26	E

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Surge line pipe and elbows	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	CASS evaluation	IV.C2.1-f	3.1.1-24	A
					Inservice inspection	IV.C2.1-f	3.1.1-24	E
				Cracking	Water chemistry control	IV.C2.1-e	3.1.1-13	A, 104
					Inservice inspection	IV.C2.1-e	3.1.1-13	E, 104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.1-b	3.1.1-1	B
Surge line piping: - RTD nozzles - Sampling nozzles	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	A
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-c	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Valves								
Carbon / alloy steel bolting	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection	IV.C2.4-e	3.1.1-26	E
				Loss of material	Boric acid corrosion prevention	IV.C2.4-f	3.1.1-38	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	B
				Loss of mechanical closure integrity	Inservice inspection Bolting and torquing activities	IV.C2.4-g	3.1.1-26	E

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve bodies and bonnets	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	C
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-a	3.1.1-1	B
		CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	Inservice inspection	IV.C2.4-c	3.1.1-23	E
				Cracking	Water chemistry control	IV.C2.4-b	3.1.1-36	A, 104
					Inservice inspection	IV.C2.4-b	3.1.1-36	E, 104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-a	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Class 2 and 3 Piping and Valves								
Class 2 and 3 closure bolting	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection	IV.C2.4-e	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	B
				Loss of material	Boric acid corrosion prevention	IV.C2.4-f	3.1.1-38	A
				Loss of mechanical closure integrity	Bolting and torquing activities Inservice inspection	IV.C2.4-g	3.1.1-26	E
Class 2 and 3 fittings	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	A
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 2 and 3 pipe	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.2-f	3.1.1-36	E
					Water chemistry control	IV.C2.2-f	3.1.1-36	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 2 and 3 valve bodies and bonnets	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	C
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-a	3.1.1-1	B
		CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	Inservice inspection	IV.C2.4-c	3.1.1-23	E
				Cracking	Water chemistry control	IV.C2.4-b	3.1.1-36	A,104
					Inservice inspection	IV.C2.4-b	3.1.1-36	E,104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-a	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	A
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-b	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Coolant Pump (RCP)								
RCP casing	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Reduction in fracture toughness	Inservice inspection	IV.C2.3-c	3.1.1-23	E
				Cracking	Water chemistry control	IV.C2.3-b	3.1.1-36	A, 104
					Inservice inspection	IV.C2.3-b	3.1.1-36	E, 104
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.3-a	3.1.1-1	B

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
RCP cover	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control Inservice inspection			H
				Reduction in fracture toughness	Inservice inspection	IV.C2.3-c	3.1.1-23	E
				Cracking	Water chemistry control	IV.C2.3-b	3.1.1-36	C
					Inservice inspection	IV.C2.3-b	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.3-a	3.1.1-1	B
			Treated water (external)	Loss of material	Water chemistry control			G
				Reduction in fracture toughness	Inservice inspection			G
				Cracking	Water chemistry control Inservice inspection			G
				Cracking (fatigue)	TLAA-metal fatigue			G

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor coolant pump cover studs Reactor coolant pump cover nuts	Pressure boundary	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.3-f	3.1.1-38	A
				Cracking	Inservice inspection	IV.C2.3-e	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.3-d	3.1.1-1	B
				Loss of mechanical closure integrity	Inservice inspection Bolting and torquing activities	IV.C2.3-g	3.1.1-26	E
RCP driver mount assembly	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-u	3.1.1-38	C
					System walkdown			101
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-t	3.1.1-1	D

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor coolant pump thermal barrier heat exchanger inner coil	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control Inservice inspection			101
				Cracking	Water chemistry control Inservice inspection			101
				Cracking (fatigue)	TLAA-metal fatigue			101
			Treated water (external)	Loss of material	Inservice inspection			J
				Cracking	Inservice inspection			J
				Cracking (fatigue)	TLAA-metal fatigue			J

Table 3.1.2-3 Class 1 Piping, Valves, and Reactor Coolant Pumps (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Reactor coolant pump thermal barrier heat exchanger outer coil Reactor coolant pump thermal barrier bored hole heat exchanger	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	Inservice inspection			J
				Cracking	Inservice inspection			J
				Cracking (fatigue)	TLAA-metal fatigue			J

Table 3.1.2-4
Reactor Coolant System - Pressurizer
Summary of Aging Management

Table 3.1.2-4 Pressurizer								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heater end plug Heater sheaths Heater sleeves	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.5-s	3.1.1-14	E
					Water chemistry control	IV.C2.5-s	3.1.1-14	A
					Alloy 600 aging management	IV.C2.5-s	3.1.1-14	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	B
Heater support channel	SSR	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-r	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heater support plates Heater support plate brackets	SSR	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-s	3.1.1-14	C
					Alloy 600 aging management	IV.C2.5-s	3.1.1-14	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D
Heater support plate bracket bolts	SSR	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-r	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lower head Lower shell Upper shell Upper head	Pressure boundary	Low alloy steel clad with stainless steel and nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.5-c	3.1.1-36	E
					Water chemistry control	IV.C2.5-c	3.1.1-36	A
					Pressurizer examinations	IV.C2.5-c	3.1.1-36	E
					Alloy 600 aging management	IV.C2.5-c	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-a	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-b	3.1.1-38	A
					System walkdown			H

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Lower head Lower shell Upper shell Upper head (continued)	Pressure boundary	Unclad low alloy steel (lower head only)	Treated borated water (external)	Loss of material	Inservice inspection	IV.C2.5-b	3.1.1-38	E
					Boric acid corrosion prevention	IV.C2.5-b	3.1.1-38	A
Lower level nozzle	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-g	3.1.1-36	C
					Inservice inspection	IV.C2.5-g	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	D

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manway cover bolts/studs	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection	IV.C2.5-n	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Loss of material	Boric acid corrosion prevention	IV.C2.5-o	3.1.1-38	A
				Loss of mechanical closure integrity	Inservice inspection Bolting and torquing activities	IV.C2.5-p	3.1.1-26	E
Manway cover plate	Pressure boundary	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-o	3.1.1-38	A
					System walkdown			H
				Cracking (fatigue)	TLAA-metal fatigue			H

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manway forging	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.5-m	3.1.1-36	E
					Water chemistry control	IV.C2.5-m	3.1.1-36	A
					Pressurizer examinations	IV.C2.5-m	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-a	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-o	3.1.1-38	A
					System walkdown			H

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manway gasket retainer plate	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			J
				Cracking	Water chemistry control	IV.C2.5-r	3.1.1-36	C
					Inservice inspection	IV.C2.5-r	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D
MNSA bolting (studs, nuts, and washers)	Pressure boundary	Stainless steel	Air (external)	Cracking	Inservice inspection	IV.C2.4-e	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
MNSA compression collar MNSA upper flanges	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-h	3.1.1-36	C
					Inservice inspection	IV.C2.5-h	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	D

Table 3.1.2-4 Pressurizer (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Pressure measurement nozzle Upper level nozzle Vent nozzle Temperature nozzle	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Inservice inspection	IV.C2.5-k	3.1.1-14	E
					Water chemistry control	IV.C2.5-k	3.1.1-14	C
					Alloy 600 aging management	IV.C2.5-k	3.1.1-14	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	D
Pressure measurement nozzle safe end Upper/lower level nozzle safe end Temperature nozzle safe end Vent nozzle safe end	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.5-h	3.1.1-36	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	B

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Safety valve nozzle Spray nozzle Surge nozzle	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.5-g	3.1.1-36	E
					Water chemistry control	IV.C2.5-g	3.1.1-36	A
					Pressurizer examinations	IV.C2.5-g	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-d IV.C2.5-e	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-b	3.1.1-38	C
					System walkdown			101
Safety valve nozzle flange	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.2-f	3.1.1-36	A
					Inservice inspection	IV.C2.2-f	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.2-a	3.1.1-1	B

Table 3.1.2-4 Pressurizer (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Spray nozzle safe end	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.C2.5-h	3.1.1-36	A, 102
					Inservice inspection	IV.C2.5-h	3.1.1-36	E, 102
					Alloy 600 aging management (welds)	IV.C2.5-k	3.1.1-14	E, 102
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	B
Spray nozzle thermal sleeve Surge nozzle thermal sleeve	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Inservice inspection	IV.C2.5-k	3.1.1-14	E
					Water chemistry control	IV.C2.5-k	3.1.1-14	C
					Alloy 600 aging management	IV.C2.5-k	3.1.1-14	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-f	3.1.1-1	B

Table 3.1.2-4 Pressurizer (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Support skirt	SSR	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.C2.5-u	3.1.1-38	A
					System walkdown			H
				Cracking	Inservice inspection	IV.C2.5-v	3.1.1-41	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-t	3.1.1-1	B
Surge nozzle safe end	Pressure boundary	CASS	Treated borated water (internal)	Loss of material	Water chemistry control			F
				Reduction in fracture toughness	CASS evaluation	IV.C2.5-l	3.1.1-24	C
					Inservice inspection	IV.C2.5-l	3.1.1-24	E
				Cracking	Water chemistry control	IV.C2.5-i	3.1.1-13	C, 102
					Inservice inspection	IV.C2.5-i	3.1.1-13	E, 102
					Alloy 600 aging management (welds)	IV.C2.5-k	3.1.1-14	E, 102
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-e	3.1.1-1	D

Table 3.1.2-5
Steam Generator
Summary of Aging Management

Table 3.1.2-5 Steam Generators								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary Side								
Channel head Primary inlet nozzle Primary nozzle safe ends Primary outlet nozzle	Pressure boundary	Low alloy steel clad with stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.D1.1-i	3.1.1-44	A
					Inservice inspection	IV.D1.1-i	3.1.1-44	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-h	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			101

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Channel head divider plate	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.D1.1-j	3.1.1-44	C
					Inservice inspection	IV.D1.1-j	3.1.1-44	E
					Alloy 600 aging management	IV.D1.1-j	3.1.1-44	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D
Primary bolting: Studs, closure nuts and washers, and screws	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection	IV.D1.1-l	3.1.1-26	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Loss of mechanical closure integrity	Bolting and torquing activities Inservice inspection	IV.D1.1-f	3.1.1-26	E
				Loss of material	Boric acid corrosion prevention	IV.D1.1-k	3.1.1-38	A
Primary manway cover	Pressure boundary	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-k	3.1.1-38	A
					System walkdown			H

Table 3.1.2-5 Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Primary manway insert plate	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-r	3.1.1-36	C
					Inservice inspection	IV.C2.5-r	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-h	3.1.1-1	D
Primary nozzle closure rings	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.D1.1-j	3.1.1-44	C
					Inservice inspection	IV.D1.1-j	3.1.1-44	E
					Alloy 600 aging management	IV.D1.1-j	3.1.1-44	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D
Tube plate	Pressure boundary	Low alloy steel clad with nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube plate (continued)	Pressure boundary	Low alloy steel clad with nickel based alloy	Treated borated water (internal)	Cracking	Water chemistry control	IV.D1.1-i	3.1.1-44	C
					Alloy 600 aging management	IV.D1.1-i	3.1.1-44	E
					Inservice inspection	IV.D1.1-i	3.1.1-44	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.2-d	3.1.1-1	D
			Treated water (internal)	Loss of material	Water chemistry control	IV.D1.1-c	3.1.1-2	E
				Cracking	Inservice inspection Water chemistry control Steam generator integrity			F
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-b	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			F

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube plugs	Pressure boundary	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control Steam generator integrity	IV.D1.2-i	3.1.1-18	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.5-q	3.1.1-1	D
U-tubes	Pressure boundary Heat transfer	Nickel based alloy	Treated borated water (internal)	Loss of material	Water chemistry control			H
				Cracking	Water chemistry control	IV.D1.2-a	3.1.1-18	A
					Steam generator integrity	IV.D1.2-a	3.1.1-18	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.2-d	3.1.1-1	B

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
U-tubes (continued)	Pressure boundary Heat transfer	Nickel based alloy	Treated water (external)	Loss of material	Water chemistry control Steam generator integrity	IV.D1.2-e IV.D1.2-f	3.1.1-18	A
				Fouling	Water chemistry control Steam generator integrity			H
				Cracking	Water chemistry control Steam generator integrity	IV.D1.2-b IV.D1.2-c	3.1.1-18	A
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.2-d	3.1.1-1	B

Table 3.1.2-5 Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Secondary Side								
3" Inspection port cover	Pressure boundary	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			101
3" Inspection port diaphragms	Pressure boundary	Nickel based alloy	Treated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control	IV.C2.5-s	3.1.1-36	C
					Inservice inspection	IV.C2.5-s	3.1.1-36	E
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-h	3.1.1-1	D
6" Inspection port cover 8" Hand hole cover	Pressure boundary	Low alloy steel	Treated water (internal)	Loss of material	Water chemistry control	IV.D1.1-c	3.1.1-2	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-b	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			101

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Anti-vibration bars Tube support plates	SSR	Stainless steel	Treated water (internal)	Loss of material	Water chemistry control Steam generator integrity			F
				Cracking	Water chemistry control Inservice inspection Steam generator integrity			F, 105
				Cracking (fatigue)	TLAA-metal fatigue			F

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Anti-vibration bar end caps Peripheral retaining rings U-bend U-shaped retainer bars	SSR	Nickel based alloy	Treated water (internal)	Loss of material	Water chemistry control Steam generator integrity			101
				Cracking	Water chemistry control Steam generator integrity			101, 105
				Cracking (fatigue)	TLAA-metal fatigue			101

Table 3.1.2-5 Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blowdown and sampling nozzles Narrow and wide range water level taps	Pressure boundary	Low alloy steel	Treated water (internal)	Loss of material	Water chemistry control	IV.D1.1-c	3.1.1-2	E
				Cracking	Water chemistry control Inservice inspection			101
				Cracking (fatigue)	TLAA-metal fatigue			101
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			101
Elliptical head Transition cone Upper and lower shell barrels	Pressure boundary	Low alloy steel	Treated water (internal)	Loss of material	Water chemistry control	IV.D1.1-c	3.1.1-2	A
					Inservice inspection	IV.D1.1-c	3.1.1-2	E
				Cracking	Water chemistry control			H
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-a IV.D1.1-b	3.1.1-1	B

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Elliptical head Transition cone Upper and lower shell barrels (continued)	Pressure boundary	Low alloy steel	Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	A
					System walkdown			G
Feedwater inlet nozzles	Pressure boundary	Low alloy steel	Treated water (internal)	Loss of material	Flow-accelerated corrosion	IV.D1.1-d	3.1.1-25	A, 106
					Water chemistry control	IV.D1.1-c	3.1.1-2	C, 106
				Cracking	Inservice inspection			H
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-b	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			G

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Feedwater thermal sleeve	Pressure boundary	Nickel based alloy	Treated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control Inservice inspection			101
				Cracking (fatigue)	TLAA-metal fatigue			101
Flow limiting insert (integral flow restrictors (venturis))	Pressure boundary, Flow control	Nickel based alloy	Treated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control Inservice inspection			101
				Cracking (fatigue)	TLAA-metal fatigue			101

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Key bracket Snubber lug	SSR	Low alloy steel	Air (external)	Cracking	Inservice inspection Steam generator integrity			101, 105
				Cracking (fatigue)	TLAA-metal fatigue			101
				Loss of material	Boric acid corrosion prevention			101
					System walkdown			101
Secondary bolting: studs, closure washers and nuts	Pressure boundary	Low alloy steel	Air (external)	Cracking	Inservice inspection			101
				Cracking (fatigue)	TLAA-metal fatigue	IV.C2.4-d	3.1.1-1	D
				Loss of mechanical closure integrity	Bolting and torquing activities Inservice inspection	IV.D1.1-f	3.1.1-26	E
				Loss of material	Boric acid corrosion prevention	IV.D1.1-k	3.1.1-38	C

Table 3.1.2-5 Steam Generators (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Secondary manway cover	Pressure boundary	Low alloy steel	Treated water (internal)	Loss of material	Water chemistry control	IV.D1.1-c	3.1.1-2	C
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-b	3.1.1-1	D
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			H
Steam outlet nozzle	Pressure boundary	Low alloy steel clad with nickel based alloy	Treated water (internal)	Loss of material	Water chemistry control			F
				Cracking	Inservice inspection			F
				Cracking (fatigue)	TLAA-metal fatigue	IV.D1.1-a	3.1.1-1	B
			Air (external)	Loss of material	Boric acid corrosion prevention	IV.D1.1-g	3.1.1-38	C
					System walkdown			F

Table 3.1.2-5 Steam Generators (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube bundle support system: -stay rods -stay rod hex nuts -spacer pipes -peripheral backup bars	SSR	Low alloy and carbon steel	Treated water (internal)	Loss of material	Water chemistry control Steam generator integrity			101
				Cracking	Water chemistry control Steam generator integrity			101, 105
				Cracking (fatigue)	TLAA-metal fatigue			101
Wrapper Wrapper jacking screws	Heat transfer	Carbon steel	Treated water (internal)	Loss of material	Water chemistry control			101
				Cracking	Water chemistry control Steam generator integrity			101, 105
				Cracking (fatigue)	TLAA-metal fatigue			101

3.2 ENGINEERED SAFETY FEATURES SYSTEMS

3.2.1 Introduction

This section provides the results of the aging management reviews for components in the engineered safety features (ESF) systems that are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- Emergency core cooling system (Section 2.3.2.1)
- Containment spray system (Section 2.3.2.2)
- Containment cooling system (Section 2.3.2.3)
- Containment penetrations system (Section 2.3.2.4)
- Hydrogen control system (Section 2.3.2.5)

Table 3.2.1, Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the engineered safety features component groups. This table uses the format described in the introduction to Section 3. Hyperlinks to the program evaluations in Appendix B are provided.

3.2.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the ESF system group.

- Table 3.2.2-1 Emergency Core Cooling System — Summary of Aging Management Evaluation
- Table 3.2.2-2 Containment Spray System —Summary of Aging Management Evaluation
- Table 3.2.2-3 Containment Cooling System — Summary of Aging Management Evaluation
- Table 3.2.2-4 Containment Penetrations System — Summary of Aging Management Evaluation
- Table 3.2.2-5 Hydrogen Control System — Summary of Aging Management Evaluation

3.2.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the ESF systems. Programs are described in Appendix B. Further details are provided in the system tables.

In this application, carbon steel includes the alloy steel identified in NUREG-1801. Copper alloy includes brass, aluminum-bronze, copper-nickel and bronze material.

3.2.2.1.1 Emergency Core Cooling System

Materials

Emergency core cooling system components are constructed of the following materials.

- carbon steel
- carbon steel with stainless steel cladding
- inconel
- stainless steel
- cast iron

Environment

Emergency core cooling system components are exposed to the following environments.

- air
- fresh raw water
- nitrogen
- treated borated water
- treated borated water >270°F

For carbon steel components in the emergency core cooling system, the external air environment can also include leaking borated water.

Aging Effects Requiring Management

The following aging effects associated with the emergency core cooling system require management.

- cracking
- cracking - fatigue
- fouling
- loss of material
- loss of material - wear
- loss of mechanical closure integrity

Aging Management Programs

The following aging management programs manage the aging effects for the emergency core cooling system components.

- boric acid corrosion prevention
- periodic surveillance and preventive maintenance
- water chemistry control
- system walkdown
- service water integrity

3.2.2.1.2 Containment Spray System

Materials

Containment spray system components are constructed of the following materials.

- carbon steel
- stainless steel
- ferritic stainless steel
- carbon steel clad with stainless steel
- cast stainless steel

Environment

Containment spray system components are exposed to the following environments.

- air
- outdoor air
- fresh raw water
- treated borated water
- treated borated water >270°F
- untreated borated water

For carbon steel components in the containment spray system, the external air environment can also include leaking borated water.

Aging Effects Requiring Management

The following aging effects associated with the containment spray system require management.

- cracking
- cracking - fatigue
- fouling
- loss of material
- loss of material - wear
- loss of mechanical closure integrity

Aging Management Programs

The following aging management programs manage the aging effects for the containment spray system components.

- boric acid corrosion prevention
- heat exchanger monitoring
- periodic surveillance and preventive maintenance
- service water integrity
- system walkdown
- water chemistry control

3.2.2.1.3 Containment Cooling System

Materials

Containment cooling system components are constructed of the following materials.

- carbon steel
- stainless steel
- copper alloy

Environment

Containment cooling system components are exposed to the following environments.

- air
- condensation

- fresh raw water

Aging Effects Requiring Management

The following aging effects associated with the containment cooling system require management.

- fouling
- loss of material
- loss of material – wear

Aging Management Programs

The following aging management programs manage the aging effects for the containment cooling system components.

- system walkdown
- periodic surveillance and preventive maintenance
- service water integrity

3.2.2.1.4 Containment Penetrations System

Materials

Containment penetrations system components are constructed of the following materials.

- carbon steel
- copper alloy
- stainless steel
- elastomer

Environment

Containment penetrations system components are exposed to the following environments.

- air
- concrete
- condensation
- nitrogen
- treated water

- treated water > 270°F
- untreated borated water

For carbon steel components in the containment penetrations system, the external air environment can also include leaking borated water.

Aging Effects Requiring Management

The following aging effects associated with the containment penetrations system require management.

- cracking
- cracking - fatigue
- change in material properties
- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following aging management programs manage the aging effects for the containment penetrations system components.

- boric acid corrosion prevention
- bolting and torquing activities
- containment leak rate
- flow-accelerated corrosion
- periodic surveillance and preventive maintenance
- water chemistry control

3.2.2.1.5 Hydrogen Control System

Materials

Hydrogen control system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Hydrogen control system components are exposed to the following environments.

- air

- condensation
- fresh raw water

Aging Effects Requiring Management

The following aging effects associated with the hydrogen control system require management.

- fouling
- loss of material
- loss of material - wear

Aging Management Programs

The following aging management programs manage the aging effects for the hydrogen control system components.

- system walkdown
- service water integrity

3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant specific programs or that involve TLAAs. Section 3.2.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the ANO-2 approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.2.2.2.1 Cumulative Fatigue Damage

NUREG-1801, Volume 2, Chapter V, Table D1 line items for fatigue list an environment of borated water at temperature less than 93°C (200°F). ANO-2 aging management reviews do not consider cumulative fatigue damage a concern for stainless steel unless the system temperature exceeds 270°F. Where identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10CFR54.3. TLAAs are evaluated in accordance with 10CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

3.2.2.2.2 Loss of Material Due to General Corrosion

1) Paragraph 1 of this section of NUREG-1800 is applicable to BWRs only.

2) This paragraph does not apply for components in containment spray and ECCS as the associated components are not carbon steel in these systems at

ANO-2. For containment isolation, the containment leak rate and water chemistry control programs are credited with managing this aging effect.

3.2.2.2.3 Local Loss of Material due to Pitting and Crevice Corrosion

1) Paragraph 1 of this section of NUREG-1800 is applicable to BWRs only.

2) With respect to paragraph 2, for the components relevant to this discussion, the programs credited with managing the aging effects are water chemistry control and containment leak rate.

3.2.2.2.4 Local Loss of Material due to Microbiologically Influenced Corrosion

For the components relevant to this discussion, the programs credited with managing the aging effects are containment leak rate and water chemistry control.

3.2.2.2.5 Changes in Material Properties due to Elastomer Degradation

The discussion in this paragraph of NUREG-1800 applies only to degradation of seals associated with the standby gas treatment system, which is applicable to BWRs only.

3.2.2.2.6 Local Loss of Material due to Erosion

This discussion in NUREG-1800 relates to a high pressure safety injection pump miniflow orifice, which is not applicable to ANO-2 as the chemical and volume control charging pumps are used for RCS makeup, not the high pressure safety injection pumps. There are no orifices downstream of chemical and volume control charging pumps.

3.2.2.2.7 Buildup of Deposits due to Corrosion

The discussion in this paragraph of NUREG-1800 is applicable to BWRs only.

3.2.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10CFRPart 50, Appendix B. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 corrective action program. Administrative controls for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.2.2.3 Time-Limited Aging Analyses

The only time-limited aging analysis (TLAA) identified for the ESF systems components is metal fatigue. This is evaluated in Section 4.3.

3.2.3 Conclusion

The ESF system components that are subject to aging management review have been identified in accordance with the requirements of 10CFR54.21. The aging management programs selected to manage the effects of aging on ESF components are identified in the following tables and Section 3.2.2.1.

A description of these aging management programs is provided in Appendix B of the LRA, 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 of the LRA, the effects of aging associated with the ESF components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.2.1
Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-1	Piping, fittings, and valves in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10CFR54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.2.2.2.1)	The system temperatures assumed in the line items in NUREG-1801 Volume 2, Chapter V, that refer to this row number are inconsistent with the temperature threshold for cumulative fatigue damage used in the aging management reviews. See Section 3.2.2.2.1 for further discussion.
3.2.1-2	BWR only				
3.2.1-3	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to general corrosion	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.2.2.2.2.2)	Consistent with NUREG-1801 for containment isolation. The containment leak rate and water chemistry control programs are credited with managing this aging effect. See Section 3.2.2.2.2 for further evaluation.
3.2.1-4	BWR only				

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-5	Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to pitting and crevice corrosion	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.2.2.2.3.2)	Consistent with NUREG-1801 for containment isolation. Containment leak rate and water chemistry control programs are credited with managing this aging effect. There are no components from containment spray or ECCS that reference this item number.
3.2.1-6	Containment isolation valves and associated piping	Loss of material due to microbiologically influenced corrosion (MIC)	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.2.2.2.4)	Consistent with NUREG-1801. Water chemistry control and containment leak rate programs are credited with managing this aging effect.
3.2.1-7	BWR only				
3.2.1-8	High pressure safety injection (charging) pump miniflow orifice	Loss of material due to erosion	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.2.2.2.6)	No items from the following tables refer to this line item. The safety injection pumps are not normally in use. The chemical and volume control charging pumps are used for RCS makeup and they have no orifices.
3.2.1-9	BWR only				

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-10 (NUREG-1801 only)	External surface of carbon steel components	Loss of material due to general corrosion	Plant specific	Yes, plant specific	Consistent with NUREG-1801. The system walkdown, boric acid corrosion prevention, and containment leak rate programs are credited with managing this aging effect.
3.2.1-11	Piping and fittings of CASS in emergency core cooling system	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	No	There are no CASS components in ECCS at ANO-2.
3.2.1-12	Components serviced by open-cycle cooling system	Loss of material due to general, pitting and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	The service water integrity program is comparable to the NUREG-1801 open-cycle cooling water system program. As supplemented by heat exchanger monitoring, periodic surveillance and preventive maintenance, and water chemistry control, this program manages loss of material and fouling. Although biofouling is not, in itself, an aging effect, the programs will manage the effects which may result from biofouling.
3.2.1-13	Components serviced by closed-cycle cooling system	Loss of material due to general, pitting, and crevice corrosion	Closed-cycle cooling water system	No	The components in these systems are not cooled by a closed cycle cooling water system. This line item is therefore not applicable to ANO-2.
3.2.1-14	BWR only				

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-15	Pumps, valves, piping, and fittings, and tanks in containment spray and emergency core cooling systems	Crack initiation and growth due to SCC	Water chemistry	No	The line items in NUREG-1801 Volume 2 that refer to this row number specify a temperature less than 93°C (200°F). The aging management reviews consider a threshold for SCC of 140°F. Environments for the systems are either less than 140°Fsuch that cracking is not an aging effect requiring management, or greater than 270°F, which is outside the range of the NUREG-1801 listed environment. The items from the following tables referring to this row number had a temperature between 140°Fand 270°F. The water chemistry control program is credited with managing stress corrosion cracking for stainless steel in borated water at temperatures above the 140°Fthreshold for SCC.
3.2.1-16	BWR only				
3.2.1-17	Carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. The boric acid corrosion prevention program will manage this aging effect. The system walkdown program supplements this program to manage loss of material.

Table 3.2.1: Engineered Safety Features, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.2.1-18	Closure bolting in high pressure or high temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	No	This item was not referenced since it was not considered to match the ANO-2 aging management review results. For this component, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item. The bolting and torquing activities, boric acid corrosion prevention and system walkdown programs will manage loss of mechanical closure integrity.

Notes for Tables 3.2.2-1 through 3.2.2-5

Generic notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 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

201. The material and environment combination is in NUREG-1801 but neither the plant component, nor a reasonable substitute, exists.

202. The temperature in this portion of the system is below the threshold for cracking, both from fatigue and from stress corrosion.

203. NUREG-1801 V.C.1-b identifies an aging effect applicable to the internal environment only.

204. NUREG-1801 only discusses biofouling. As used in the table, fouling is not restricted to biofouling only, but includes other causes of fouling.

205. As used in the table, the NUREG-1801 environment of chemically treated borated water is the same as the ANO-2 environment of treated borated water > 270F. The temperature is listed to identify the threshold for thermal fatigue.

Table 3.2.2-1
Emergency Core Cooling System
Summary of Aging Management

Table 3.2.2-1 Emergency Core Cooling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bearing housing	Heat transfer	Cast iron	Fresh raw water (internal)	Fouling	Periodic surveillance and preventive maintenance	V.D1.6-c	3.2.1-12	E, 204
	Pressure boundary	Cast iron	Air (external)	Loss of material	Boric acid corrosion prevention	V.E.1-a	3.2.1-17	A
					System walkdown	V.E.1-b	3.2.1-10	A
			Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	V.D1.6-b	3.2.1-12	E
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	V.D1.1-d	3.2.1-17	A
					System walkdown	V.E.1-b	3.2.1-10	A

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (continued)	Pressure boundary	Carbon steel	Air (external)	Loss of mechanical closure integrity	Boric acid corrosion prevention			H
					System walkdown			H
		Stainless steel	Air (external)	None	None			F
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Service water integrity	V.D1.6-b	3.2.1-12	B
Heat exchanger (tubes)	Heat transfer	Stainless steel	Fresh raw water (external)	Fouling	Service water integrity	V.D1.6-c	3.2.1-12	C, 204
			Treated borated water (internal)	Fouling	Periodic surveillance and preventive maintenance	V.D1.6-c	3.2.1-12	E, 204
					Water chemistry control	V.D1.6-c	3.2.1-12	E, 204
			Treated borated water >270°F (internal)	Fouling	Periodic surveillance and preventive maintenance	V.D1.6-c	3.2.1-12	E, 204, 205
					Water chemistry control	V.D1.6-c	3.2.1-12	E, 204, 205

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Stainless steel	Fresh raw water (external)	Cracking	Service water integrity			G
				Loss of material	Service water integrity			G
				Loss of material-wear	Service water integrity			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.1-a	3.2.1-15	C
				Loss of material	Water chemistry control			G
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
Nozzle	Pressure boundary	Inconel	Air (external)	None	None			F
			Treated borated water (internal)	Loss of material	Water chemistry control			F

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.1-a	3.2.1-15	C
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.1-a	3.2.1-15	C
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.1-a	3.2.1-15	A
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.2-a	3.2.1-15	A
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
			Treated borated water >270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel with stainless cladding	Air (external)	Loss of material	Boric acid corrosion prevention	V.D1.7-a	3.2.1-17	A
					System walkdown	V.E.1-b	3.2.1-10	A
			Treated borated water (internal)	Loss of material	Water chemistry control			H
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			J
			Treated borated water >270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Water chemistry control			J

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.1-a	3.2.1-15	A
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
			Treated borated water >270°F (internal)	Loss of material	Water chemistry control			G

Table 3.2.2-1 Emergency Core Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Nitrogen (internal)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	V.D1.4-b	3.2.1-15	A
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
			Treated borated water >270°F (internal)	Loss of material	Water chemistry control			G

Table 3.2.2-2
Containment Spray System
Summary of Aging Management

Table 3.2.2-2 Containment Spray System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	V.A.1-b V.A.3-b V.A.4-b V.A.5-b V.A.6-d V.D1.3-a	3.2.1-17	A
				Loss of mechanical closure integrity	Boric acid corrosion prevention			H
					System walkdown			H

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (continued)	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	Boric acid corrosion prevention	V.D1.8-b	3.2.1-17	A
				Loss of mechanical closure integrity	Boric acid corrosion prevention			H
			Outdoor air (external)	Loss of mechanical closure integrity	System walkdown			H
		Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
Filter housing	Filtration Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			201
	Pressure boundary	Stainless steel	Air (external)	None	None			J

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	V.E.1-b	3.2.1-10	A
			Fresh raw water (internal)	Loss of material	Heat exchanger monitoring	V.A.6-a	3.2.1-12	E
			Fresh raw water (internal)	Loss of material	Service water integrity	V.A.6-a	3.2.1-12	B
Heat exchanger (tubes)	Heat transfer	Ferritic stainless steel	Fresh raw water (external)	Fouling	Service water integrity	V.A.6-b	3.2.1-12	B, 204
			Treated borated water >270°F (internal)	Fouling	Service water integrity	V.A.6-b	3.2.1-12	B, 204, 205
					Water chemistry control	V.A.6-b	3.2.1-12	E, 204, 205
		Stainless steel	Fresh raw water (external)	Fouling	Service water integrity	V.D1.6-c	3.2.1-12	C, 204
			Treated borated water (internal)	Fouling	Periodic surveillance and preventive maintenance	V.D1.6-c	3.2.1-12	E, 204
					Water chemistry control	V.D1.6-c	3.2.1-12	E, 204

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Ferritic stainless steel	Fresh raw water (external)	Cracking	Heat exchanger monitoring			H
				Loss of material	Heat exchanger monitoring	V.A.6-a	3.2.1-12	E
				Loss of material-wear	Heat exchanger monitoring			H
			Treated borated water >270°F (internal)	Cracking	Heat exchanger monitoring			H
					Water chemistry control			H
				Cracking-fatigue	TLAA-metal fatigue			H
			Treated borated water >270°F (internal)	Loss of material	Heat exchanger monitoring	V.A.6-a	3.2.1-12	E, 205
					Water chemistry control	V.A.6-a	3.2.1-12	E, 205
		Stainless steel	Fresh raw water (external)	Loss of material	Service water integrity	V.A.6-a	3.2.1-12	D
				Loss of material-wear	Service water integrity			H
			Treated borated water (internal)	Loss of material	Water chemistry control	V.A.6-a	3.2.1-12	E

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubesheet)	Pressure boundary	Carbon steel with stainless cladding	Fresh raw water (external)	Cracking	Heat exchanger monitoring			H
				Loss of material	Heat exchanger monitoring	V.A.6-a	3.2.1-12	E
				Loss of material-wear	Heat exchanger monitoring			H
Heater housing	Pressure boundary	Stainless steel	Outdoor air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control	V.D1.6-a	3.2.1-13	A
Nozzle	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated borated water (internal)	Loss of material	Water chemistry control			F

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G

Table 3.2.2-2 Containment Spray System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Outdoor air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
			Treated borated water >270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
Pump casing	Pressure boundary	Cast stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Stainless steel	Outdoor air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			G

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing (continued)	Pressure boundary	Stainless steel	Outdoor air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202
			Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Outdoor air (external)	None	None			G
			Treated borated water (internal)	Loss of material	Water chemistry control			H, I, 202

Table 3.2.2-2 Containment Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Stainless steel	Treated borated water >270°F (internal)	Cracking	Water chemistry control			G
				Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Water chemistry control			G
			Untreated borated water (external)	Loss of material	Periodic surveillance and preventive maintenance			G
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
Vortex breaker	Vortex elimination	Stainless steel	Untreated borated water (external)	Loss of material	Periodic surveillance and preventive maintenance			J
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			J

Table 3.2.2-3
Containment Cooling System
Summary of Aging Management

Table 3.2.2-3 Containment Cooling System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
			Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance			F

Table 3.2.2-3 Containment Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cooling coil assembly	Heat transfer	Copper alloy	Condensation (external)	Fouling	Periodic surveillance and preventive maintenance			H
			Fresh raw water (internal)	Fouling	Service water integrity			G
	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance			F
			Fresh raw water (internal)	Loss of material	Service water integrity			F
		Copper alloy	Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.F3.2-a	3.3.1-5	A
				Loss of material-wear	Periodic surveillance and preventive maintenance			H
			Fresh raw water (internal)	Loss of material	Service water integrity			G

Table 3.2.2-3 Containment Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cooling coil assembly (continued)	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance			F
			Fresh raw water (internal)	Loss of material	Service water integrity			F
Cooling coil housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F3.1-a	3.3.1-5	A
		Stainless steel	Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
Damper housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F3.1-a	3.3.1-5	A

Table 3.2.2-3 Containment Cooling System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F3.1-a	3.3.1-5	A
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A

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Table 3.2.2-4
Containment Penetrations System
Summary of Aging Management

Table 3.2.2-4 Containment Penetrations								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Containment leak rate	V.E.1-b	3.2.1-10	A
				Loss of mechanical closure integrity	Bolting and torquing activities			H
			Condensation (external)	Loss of material	Containment leak rate	V.E.1-b	3.2.1-10	A
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	V.E.1-a	3.2.1-17	A
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance			J

Table 3.2.2-4 Containment Penetrations (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose (continued)	Pressure boundary	Elastomer	Air (external)	Cracking	Periodic surveillance and preventive maintenance			J
			Nitrogen (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	Containment leak rate	V.C.1-a	3.2.1-3	A
			Air (internal)	Loss of material	Containment leak rate			G
			Condensation (external)	Loss of material	Containment leak rate	V.C.1-a V.C.1-a V.E.1-b	3.2.1-3 3.2.1-5 3.2.1-10	A
			Nitrogen (internal)	None	None			G

Table 3.2.2-4 Containment Penetrations (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	Containment leak rate	V.C.1-a V.C.1-a V.C.1-a	3.2.1-3 3.2.1-5 3.2.1-6	A
					Water chemistry control	V.C.1-a V.C.1-a V.C.1-a	3.2.1-3 3.2.1-5 3.2.1-6	B
			Treated water > 270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Flow-accelerated corrosion	VIII.F.1-a	3.4.1-6	A
					Water chemistry control	VIII.F.1-b	3.4.1-2	A
		Stainless steel	Air (external)	None	None			I, 203
			Air (internal)	None	None			G
			Concrete (external)	None	None			G
			Untreated borated water (internal)	Cracking	Containment leak rate			G
				Loss of material	Containment leak rate			G

Table 3.2.2-4 Containment Penetrations (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			I, 203
			Air (internal)	None	None			G
			Nitrogen (internal)	None	None			G
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	Containment leak rate	V.C.1-a	3.2.1-3	A
			Air (internal)	Loss of material	Containment leak rate			G
			Condensation (external)	Loss of material	Containment leak rate	V.C.1-a V.C.1-a V.E.1-b	3.2.1-3 3.2.1-5 3.2.1-10	A
			Nitrogen (internal)	None	None			G
			Treated water (internal)	Loss of material	Containment leak rate	V.C.1-a V.C.1-a V.C.1-a	3.2.1-3 3.2.1-5 3.2.1-6	A
					Water chemistry control	V.C.1-a V.C.1-a V.C.1-a	3.2.1-3 3.2.1-5 3.2.1-6	B

Table 3.2.2-4 Containment Penetrations (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Carbon steel	Treated water > 270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Flow-accelerated corrosion	VIII.F.1-a	3.4.1-6	A
					Water chemistry control	VIII.F.1-b	3.4.1-2	A
		Copper alloy	Air (external)	None	None			F
			Nitrogen (internal)	None	None			F
		Stainless steel	Air (external)	None	None			I, 203
			Air (internal)	None	None			G
			Nitrogen (internal)	None	None			G
			Treated water > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control	V.C.1-b	3.2.1-5	A, 205
			Untreated borated water (internal)	Cracking	Containment leak rate			G
				Loss of material	Containment leak rate			G

Table 3.2.2-5
Hydrogen Control System
Summary of Aging Management

Table 3.2.2-5 Hydrogen Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	V.E.1-b	3.2.1-10	A
		Stainless steel	Air (external)	None	None			J
Filter housing	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J
Heat exchanger (shell)	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			201
			Fresh raw water (internal)	Loss of material	Service water integrity			201

Table 3.2.2-5 Hydrogen Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Stainless steel	Fresh raw water (external)	Fouling	Service water integrity			201
			Condensation (internal)	None	None			201
	Pressure boundary	Stainless steel	Condensation (internal)	None	None			201
			Fresh raw water (external)	Loss of material	Service water integrity			201
				Loss of material-wear	Service water integrity			201
Orifice	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J

Table 3.2.2-5 Hydrogen Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Air (internal)	None	None			J

3.3 AUXILIARY SYSTEMS

3.3.1 Introduction

This section provides the results of the aging management reviews for those components in the auxiliary systems which are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- Spent fuel pool system (Section 2.3.3.1)
- Water suppression fire protection system (Section 2.3.3.2)
- Emergency diesel generator system (Section 2.3.3.3)
- Alternate AC diesel generator system (Section 2.3.3.4)
- Chemical & volume control system (Section 2.3.3.5)
- Halon fire protection and RCP motor oil leakage collection system (Section 2.3.3.6)
- Fuel oil system (Section 2.3.3.7)
- Service water system (Section 2.3.3.8)
- Auxiliary building ventilation system (Section 2.3.3.9)
- Control room ventilation system (Section 2.3.3.10)
- Miscellaneous systems in scope for 10CFR54.4(a)(2) (Section 2.3.3.11)

Table 3.3.1, Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the auxiliary systems component group. This table uses the format described in the introduction to Section 3. Hyperlinks to the program evaluations in Appendix B are provided.

3.3.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for auxiliary systems.

- Table 3.3.2-1 Spent Fuel Pool System — Summary of Aging Management Evaluation
- Table 3.3.2-2 Water Suppression Fire Protection System — Summary of Aging Management Evaluation
- Table 3.3.2-3 Emergency Diesel Generator System — Summary of Aging Management Evaluation
- Table 3.3.2-4 Alternate AC Diesel Generator System — Summary of Aging Management Evaluation
- Table 3.3.2-5 Chemical and Volume Control System — Summary of Aging Management Evaluation

- Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Leakage Collection System — Summary of Aging Management Evaluation
- Table 3.3.2-7 Fuel Oil System — Summary of Aging Management Evaluation
- Table 3.3.2-8 Service Water System — Summary of Aging Management Evaluation
- Table 3.3.2-9 Auxiliary Building Ventilation System — Summary of Aging Management Evaluation
- Table 3.3.2-10 Control Room Ventilation System — Summary of Aging Management Evaluation
- Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) — Summary of Aging Management Evaluation

3.3.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the auxiliary systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Spent Fuel Pool System

Materials

Spent fuel pool system components are constructed of the following materials.

- stainless steel
- carbon steel
- cast iron

Environment

Spent fuel pool system components are exposed to the following environments.

- treated water (borated)
- air

Aging Effects Requiring Management

The following aging effects associated with the spent fuel pool system require management.

- loss of material
- cracking

Aging Management Programs

The following programs manage the effects of aging on spent fuel pool system components.

- boric acid corrosion prevention
- system walkdown
- water chemistry control

3.3.2.1.2 Water Suppression Fire Protection System

Materials

Water suppression fire protection system components are constructed of the following materials.

- aluminum
- carbon steel
- cast iron
- cast iron with enameline
- copper
- copper alloy
- elastomer
- stainless steel

Environment

Water suppression fire protection system components are exposed to the following environments.

- air
- exhaust gas
- lube oil
- fresh raw water
- soil
- treated water

Aging Effects Requiring Management

The following aging effects associated with the water suppression fire protection system require management.

- change in material properties
- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material - wear
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on water suppression fire protection system components.

- bolting and torquing activities
- buried piping inspection
- fire protection
- system walkdown
- oil analysis

3.3.2.1.3 Emergency Diesel Generator System

Materials

Emergency diesel generator system components are constructed of the following materials.

- carbon steel
- cast iron
- copper alloy
- copper with aluminum fin
- elastomer
- stainless steel

Environment

Emergency diesel generator system components are exposed to the following environments.

- air
- exhaust gas
- lube oil
- outdoor air
- fresh raw water
- treated water
- untreated air

For the comparison tables, the environments of air, untreated air and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the emergency diesel generator system require management.

- cracking
- cracking – fatigue
- change in material properties
- fouling
- loss of material
- loss of material – wear
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on emergency diesel generator system components.

- bolting and torquing activities
- wall thinning monitoring
- heat exchanger monitoring
- system walkdown
- oil analysis

- periodic surveillance and preventive maintenance
- service water integrity
- water chemistry control

3.3.2.1.4 Alternate AC Diesel Generator System

Materials

Alternate AC diesel generator system components are constructed of the following materials.

- aluminum
- carbon steel
- carbon steel with aluminum fin
- cast iron
- copper alloy
- glass
- elastomer
- stainless steel

Environment

Alternate AC diesel generator system components are exposed to the following environments.

- air
- exhaust gas
- lube oil
- treated air
- treated water
- outdoor air

For the comparison tables, the environments of air, treated air and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the alternate AC diesel generator system require management.

- change in material properties

- cracking
- cracking – fatigue
- fouling
- loss of material
- loss of material - wear
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on alternate AC diesel generator system components.

- bolting and torquing activities
- wall thinning monitoring
- system walkdown
- oil analysis
- periodic surveillance and preventive maintenance
- water chemistry control

3.3.2.1.5 Chemical and Volume Control System

Materials

Chemical and volume control system components are constructed of the following materials.

- carbon steel
- glass
- stainless steel

Environment

Chemical and volume control system components are exposed to the following environments.

- air
- lube oil
- nitrogen
- treated borated water
- treated borated water >270°F
- treated water

Aging Effects Requiring Management

The following aging effects associated with the chemical and volume control system require management.

- cracking
- cracking – fatigue
- loss of material
- loss of material – wear
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on chemical and volume control system components.

- bolting and torquing activities
- boric acid corrosion prevention
- system walkdown
- oil analysis
- periodic surveillance and preventive maintenance
- water chemistry control

3.3.2.1.6 Halon Fire Protection and RCP Motor Oil Leakage Collection System

Materials

Halon fire protection and RCP motor oil leakage collection system components are constructed of the following materials.

- aluminum
- brass
- carbon steel
- cast bronze
- glass
- stainless steel
- stainless steel braid with Teflon liner

Environment

Halon fire protection and RCP motor oil leakage collection system components are exposed to the following environments.

- air
- halon 1301
- lube oil
- nitrogen
- untreated borated water

Aging Effects Requiring Management

The following aging effects associated with the halon fire protection and RCP motor oil leakage collection system require management.

- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on halon fire protection and RCP motor oil leakage collection system components.

- boric acid corrosion prevention
- periodic surveillance and preventive maintenance

3.3.2.1.7 Fuel Oil System

Materials

Fuel oil system components are constructed of the following materials.

- aluminum
- carbon steel
- carbon steel with aluminum fin
- cast iron
- copper alloy
- elastomer
- stainless steel

Environment

Fuel oil system components are exposed to the following environments.

- air
- fuel oil
- lube oil
- outdoor air
- sand and concrete
- soil

For the comparison tables, the environments of air and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the fuel oil system require management.

- change in material properties
- cracking
- fouling
- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on fuel oil system components.

- bolting and torquing activities
- buried piping inspection
- diesel fuel monitoring
- system walkdown
- oil analysis
- periodic surveillance and preventive maintenance

3.3.2.1.8 Service Water System

Materials

Service water system components are constructed of the following materials.

- carbon steel
- cast iron
- stainless steel

Environment

Service water system components are exposed to the following environments.

- condensation
- fresh raw water
- outdoor air
- soil

For the comparison tables, the environments of air, condensation and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the service water system require management.

- cracking
- loss of material

Aging Management Programs

The following programs manage the effects of aging on service water system components.

- buried piping inspection
- system walkdown
- periodic surveillance and preventive maintenance
- service water integrity

3.3.2.1.9 Auxiliary Building Ventilation System

Materials

Auxiliary building ventilation system components are constructed of the following materials.

- carbon steel
- copper alloy
- elastomer
- stainless steel

Environment

Auxiliary building ventilation system components are exposed to the following environments.

- air
- condensation
- freon
- outdoor air
- fresh raw water

For the comparison tables, the environments of air, condensation and outdoor air are considered the same as the various representations of air listed in NUREG-1801.

Aging Effects Requiring Management

The following aging effects associated with the auxiliary building ventilation system require management.

- change in material properties
- cracking
- fouling
- loss of material
- loss of material – wear

Aging Management Programs

The following programs manage the effects of aging on auxiliary building ventilation system components.

- system walkdown

- periodic surveillance and preventive maintenance
- service water integrity

3.3.2.1.10 Control Room Ventilation System

Materials

Control room ventilation system components are constructed of the following materials.

- aluminum
- carbon steel
- copper alloy
- elastomer
- glass
- stainless steel

Environment

Control room ventilation system components are exposed to the following environments.

- air
- carbon dioxide
- condensation
- freon
- lube oil
- fresh raw water

Aging Effects Requiring Management

The following aging effects associated with the control room ventilation system require management.

- change in material properties
- cracking
- fouling
- loss of material

Aging Management Programs

The following programs manage the effects of aging on control room ventilation system components.

- system walkdown
- periodic surveillance and preventive maintenance
- service water integrity

3.3.2.1.11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2)

Materials

Nonsafety related components affecting safety-related systems are constructed of the following materials.

- aluminum
- carbon steel
- carbon steel (coated)
- carbon steel with stainless steel clad
- copper alloy
- glass
- stainless steel

Environment

Non-safety related components affecting safety-related systems are exposed to the following environments.

- air
- condensation
- hydrazine or ammonia
- fresh raw water
- sodium hydroxide
- steam or treated water >220 °F
- treated water
- treated water > 140 °F
- treated borated water
- treated borated water > 140 °F
- treated borated water > 270 °F

- untreated water
- untreated water > 140 °F
- untreated borated water
- untreated borated water > 140 °F

Aging Effects Requiring Management

The following aging effects associated with nonsafety related components affecting safety-related systems require management.

- cracking
- cracking - fatigue
- cracking (of cladding)
- loss of material
- loss of material - erosion
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on nonsafety related components affecting safety-related systems.

- bolting and torquing activities
- boric acid corrosion prevention
- flow-accelerated corrosion
- system walkdown
- water chemistry control

3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation by the NRC reviewer is necessary for certain aging effects, particularly those that require plant specific programs or that involve TLAAs. Section 3.3.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the ANO-2 approach to these areas requiring further evaluation by the NRC reviewer. Programs are described in Appendix B.

3.3.2.2.1 Loss of Material due to General, Pitting, and Crevice Corrosion

Both subsections of this paragraph of NUREG-1800 discuss loss of material in components of the spent fuel pool system. Only a very small portion of the spent fuel pool system that supplies emergency makeup is subject to aging management review. For this portion of the spent fuel pool system the water chemistry control program will manage loss of material. The water chemistry control program provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in NUREG-1801.

3.3.2.2.2 Hardening and Cracking or Loss of Strength due to Elastomer Degradation or Loss of Material due to Wear

This paragraph of NUREG-1800 describes the potential for degradation of elastomers in collars and seals in spent fuel cooling systems and ventilation systems. As described in Section 3.3.2.2.1, only a very small portion of the spent fuel pool system is subject to aging management review. This portion of the spent fuel pool system contains no elastomers. For the ventilation systems, the periodic surveillance and preventive maintenance program manages degradation of elastomers. Elastomers are used in other systems. For these systems, management of elastomer degradation is provided by the periodic surveillance and preventive maintenance program supplemented by the fire protection program.

3.3.2.2.3 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10CFR54.3. TLAAs are required to be evaluated in accordance with 10CFR54.21(c). The evaluation of this TLAA is addressed in Section 4.3.

3.3.2.2.4 Crack Initiation and Growth due to Cracking or Stress Corrosion Cracking

The potential for cracking in the high pressure pumps of the chemical and volume control system (charging pumps) is discussed in this paragraph of NUREG-1800. The water chemistry control program manages this aging effect.

3.3.2.2.5 Loss of Material due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 discusses the loss of material from corrosion that could occur on internal and external surfaces of components exposed to air and the associated range of atmospheric conditions. Specifically included in the paragraph are the ventilation systems, diesel fuel oil, emergency diesel starting air and combustion air intake and exhaust systems, and the external carbon steel surfaces of auxiliary systems. The system walkdown program, wall thinning monitoring, and periodic surveillance and preventive maintenance program will manage loss of material. The fire protection program, which includes exceptions to NUREG-1801, manages loss of material for internal surfaces of the fire protection system.

3.3.2.2.6 Loss of Material due to General, Galvanic, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage loss of material in the reactor coolant pump oil collection system to verify the effectiveness of the fire protection program. The periodic surveillance and preventive maintenance program addresses the inspection recommendation in NUREG-1801 and will manage loss of material.

3.3.2.2.7 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Biofouling

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage loss of material in the diesel fuel oil system to verify the effectiveness of the diesel fuel monitoring program. The diesel fuel monitoring program, which includes exceptions to NUREG-1801, manages loss of material for the system. The program provides for the periodic inspection of the fuel oil tanks which addresses the one time inspection recommendation in NUREG-1801.

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10CFR Part 50, Appendix B. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 corrective action program. Administrative control for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.3.2.2.9 Crack Initiation and Growth due to Stress Corrosion Cracking and Cyclic Loading

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation of programs to manage cracking in the chemical and volume control system to verify the effectiveness of the water chemistry control program. The water chemistry program minimizes cracking in the heat exchangers. The program provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in NUREG-1801.

3.3.2.2.10 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 the spent fuel storage rack in the spent fuel storage. For ANO-2, no credit is taken for neutron absorption by the sheets of neutron absorbing materials affixed to the spent fuel racks.

3.3.2.2.11 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

This paragraph of NUREG-1800 discusses the potential for loss of material in buried piping of the service water and diesel fuel oil systems. The buried piping inspection program manages loss of material for buried components of the service water and diesel fuel oil system.

3.3.2.3 Time-Limited Aging Analyses

The only TLAA identified for auxiliary system components is metal fatigue. This is evaluated in Section 4.3.

3.3.3 Conclusion

The auxiliary system components that are subject to aging management review have been identified in accordance with the requirements of 10CFR54.21. The aging management programs selected to manage the effects of aging on auxiliary system components are identified in the following tables and Section 3.3.2.1.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the auxiliary system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.3.1
Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801

Table 3.3.1 Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-1	Components in spent fuel pool cooling and cleanup	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 subsections 3.3.2.2.1.1 and 3.3.2.2.1.2).	This line item is not referenced. The relevant components of the spent fuel pool system are stainless steel. For further evaluation, see Section 3.3.2.2.1.
3.3.1-2	Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant specific	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.2)	No elastomers in the spent fuel pool system are subject to aging management review. Various programs manage degradation of elastomers. For further evaluation, see Section 3.3.2.2.2.
3.3.1-3	Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800 subsection 3.3.2.2.3)	Consistent with NUREG-1801. The evaluation of this TLAA is discussed in Section 4.3.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-4	Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)	Crack initiation and growth due to SCC or cracking	Plant specific	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.4)	Consistent with NUREG-1801. The water chemistry control program manages cracking of chemical and volume control system components.
3.3.1-5	Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.5)	Consistent with NUREG-1801. The fire protection program, system walkdown program, wall thinning monitoring program, and periodic surveillance and preventive maintenance program manage loss of material.
3.3.1-6	Components in reactor coolant pump oil collect system of fire protection	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 subsection 3.3.2.2.6)	The periodic surveillance and preventive maintenance program addresses the inspection recommendation in NUREG-1801 and will manage loss of material.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-7	Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 subsection 3.3.2.2.7)	The diesel fuel monitoring program and periodic surveillance and preventive maintenance program manage loss of material. The Periodic surveillance and preventive maintenance program provides for the periodic inspection of the fuel oil tanks, which addresses the one time inspection recommendation in NUREG-1801.
3.3.1-8	BWR only				
3.3.1-9	Heat exchangers in chemical and volume control system	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.9)	Consistent with NUREG-1801. The water chemistry control program minimizes cracking in the heat exchangers and other components in the chemical and volume control system. The program provides for the inspection of systems when they are opened for maintenance, which addresses the verification program recommendation in NUREG-1801.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-10	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant specific	Yes, plant specific (see NUREG-1800 subsection 3.3.2.2.10)	Not applicable. No credit is taken for neutron absorption by the sheets of neutron absorbing materials affixed to the spent fuel racks.
3.3.1-11	New fuel rack assembly	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	No	Not applicable. The new fuel racks are made of aluminum and are not subject to loss of material in an air environment.
3.3.1-12	Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	No	Not applicable. No credit is taken for neutron absorption by the sheets of neutron absorbing materials affixed to the spent fuel racks.
3.3.1-13	Spent fuel storage racks and valves in spent fuel pool cooling and cleanup	Crack initiation and growth due to stress corrosion cracking	Water chemistry	No	Consistent with NUREG-1801. The water chemistry control program of the application manages cracking of the spent fuel storage racks and valves in spent fuel pool system.
3.3.1-14	Closure bolting and external surfaces of carbon steel and low-alloy steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801. The boric acid corrosion prevention program manages loss of material due to boric acid corrosion.

Table 3.3.1 Auxiliary Systems (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-15	Components in or serviced by closed-cycle cooling water system	Loss of material due to general, pitting, and crevice corrosion, and MIC	Closed-cycle cooling water system	No	The water chemistry control program, fire protection program, and periodic surveillance and preventive maintenance program manage loss of material in these components. The closed cycle cooling system subsection of the water chemistry control program corresponds, with exceptions, to the NUREG-1801 closed-cycle cooling water system program.
3.3.1-16	Cranes including bridge and trolleys and rail system in load handling system	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	No	The structures monitoring program will manage the aging effects requiring management for cranes. Cranes and other lifting devices are evaluated in Section 3.5 as part of the structures that house them, not as part of the auxiliary systems.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-17	Components in or serviced by open-cycle cooling water systems	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	With exceptions, the service water integrity program is the equivalent of the open cycle cooling system program described in NUREG-1801. The service water integrity program supplemented by the water chemistry control and periodic surveillance and preventive maintenance programs manage loss of material and fouling. Although biofouling is not, in itself, an aging effect, the programs manage the effects which may result from biofouling.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-18	Buried piping and fittings	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated (see NUREG-1800 subsection 3.3.2.2.11)	For the buried components in the auxiliary systems, the buried piping inspection program manages loss of material.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-19	Components in compressed air system	Loss of material due to general and pitting corrosion	Compressed air monitoring	No	This line item is not referenced. The components that contain instrument air and are subject to aging management review are reviewed in the system they support. The components identified in NUREG-1801for this item are carbon steel. The only carbon steel items that contain instrument air are in the containment penetrations system. For these components in the containment penetrations, a different program, the containment leak rate program, will manage the loss of material.
3.3.1-20	Components (doors and barrier penetration seals) and concrete structures in fire protection	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	No	Consistent with NUREG-1801. Fire doors and barrier penetration seals are evaluated as part of the associated structures as described in Section 3.5.
3.3.1-21	Components in water-based fire protection	Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling	Fire water system	No	For the water suppression fire protection system, the fire protection program manages loss of material.

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-22	Components in diesel fire system	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	No	This line item is not referenced. Fuel oil components for the diesel fire pump are evaluated with the fuel oil system.
3.3.1-23	Tanks in diesel fuel oil system	Loss of material due to general, pitting, and crevice corrosion	Aboveground carbon steel tanks	No	A different program is used. The system walkdown program manages loss of material for external surfaces.
3.3.1-24	Closure bolting	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	No	Different programs are used. The system walkdown program and bolting and torquing activities manage loss of material and loss of mechanical closure integrity caused by cracking.
3.3.1-25	BWR only				
3.3.1-26	BWR only				
3.3.1-27	BWR only				
3.3.1-28	BWR only				

Table 3.3.1 Auxiliary Systems (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-29	Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink	Loss of material due to selective leaching	Selective leaching of materials	No	The service water integrity program, periodic surveillance and preventive maintenance program, and the water chemistry control program of the application manage selective leaching of materials.
3.3.1-30	Fire barriers, walls, ceilings, and floors in fire protection	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring	No	This line item is not referenced. Fire barriers, walls, ceilings, and floors are evaluated as part of the associated structures in Section 3.5.

Notes for Table 3.3.2-1 through 3.3.2-11

Generic notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 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

301. The material and environment combination is in NUREG-1801 but neither the plant component, nor a reasonable substitute, exists.

302. Aging effect only applies to the carbon steel portion of the component.

303. Components are on filtration portion of control room ventilation and are not exposed to significant moisture.

304. These are nonsafety-related components with the potential to impact a safety function. Comparisons between these aging management review results and those of NUREG-1801 have not been made. Although some material and environment

combinations are represented in the NUREG-1801 results, most of these components are in systems not addressed by NUREG-1801.

305. NUREG-1801 only discusses biofouling. As used in the table, fouling is not restricted to biofouling only, but includes other causes of fouling.

Table 3.3.2-1
Spent Fuel Pool System
Summary of Aging Management Evaluation

Table 3.3.2-1 Spent Fuel Pool System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	VII.A3.1-a VII.A3.3-c	3.3.1-14	A
					System walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
Fuel transfer tube	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	Water chemistry control			J
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated borated water (internal)	Loss of material	Water chemistry control			F
Spent fuel racks	SSR	Stainless steel	Treated borated water (external)	Cracking	Water chemistry control	VII.A2.1-c	3.3.1-13	A
				Loss of material	Water chemistry control			H

Table 3.3.2-1 Spent Fuel Pool System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
			Air (internal)	None	None			F
			Treated borated water (internal)	Loss of material	Water chemistry control			F

Table 3.3.2-2
Water Suppression Fire Protection System
Summary of Aging Management Evaluation

Table 3.3.2-2 Water Suppression Fire Protection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Air dryer housing	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	D
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F4.1-a	3.3.1-5	A
			Exhaust gas (internal)	Loss of material	Fire protection	VII.H2.4-a	3.3.1-5	C
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Bolting and torquing activities	VII.I.2-b	3.3.1-24	E
			Soil (external)	Loss of material	Buried piping inspection	VII.H1.1-b	3.3.1-18	D
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Damper housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F4.1-a	3.3.1-5	A
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F4.1-a	3.3.1-5	A
Expansion joint	Pressure boundary	Elastomer	Air (external)	Change in material properties	Fire protection	VII.F4.1-b	3.3.1-2	C
				Cracking	System walkdown	VII.F4.1-b	3.3.1-2	C
			Exhaust gas (internal)	Change in material properties	Fire protection			J
				Cracking	Fire protection			J
Filter	Filtration	Copper alloy	Fresh raw water (external)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
		Stainless steel	Fresh raw water (external)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.4-a	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (internal)	Loss of material	Fire protection	VII.H2.1-a	3.3.1-15	E
		Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
		Copper alloy	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
		Stainless steel	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Fire protection	VII.F4.1-b	3.3.1-2	C
				Cracking	Fire protection	VII.F4.1-b	3.3.1-2	C
			Air (internal)	Change in material properties	Fire protection	VII.F4.1-b	3.3.1-2	C
				Cracking	Fire protection	VII.F4.1-b	3.3.1-2	C
			Exhaust gas (internal)	Change in material properties	Fire protection			J
				Cracking	Fire protection			J
			Lube oil (internal)	Change in material properties	Fire protection			J
				Cracking	Fire protection			J
			Treated water (internal)	Change in material properties	Fire protection			J
				Cracking	Fire protection			J
Gear housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			301
Governor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (housing)	Pressure boundary	Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Fire protection	VII.H2.1-a	3.3.1-15	E
Heat exchanger (shell)	Heat transfer	Copper alloy	Treated water (internal)	Fouling	Fire protection			J
	Pressure boundary	Copper alloy	Air (external)	None	None			J
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	D
			Treated water (external)	Loss of material	Fire protection			J
			Treated water (internal)	Loss of material	Fire protection			J

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper	Lube oil (internal)	Fouling	Fire protection			301
			Treated water (external)	Fouling	Fire protection			J
		Copper alloy	Fresh raw water (external)	Fouling	Fire protection			301
			Fresh raw water (internal)	Fouling	Fire protection			301
			Lube oil (internal)	Fouling	Fire protection			301
			Treated water (external)	Fouling	Fire protection			J
	Pressure boundary	Copper	Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (external)	Loss of material	Fire protection			J
				Loss of material-wear	Fire protection			J

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Copper alloy	Fresh raw water (external)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	D
				Loss of material-wear	Fire protection			301
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	D
			Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (external)	Loss of material	Fire protection			J
				Loss of material-wear	Fire protection			J
Heater housing	Pressure boundary	Copper alloy	Air (external)	None	None			J
			Treated water (internal)	Loss of material	Fire protection			J
Nozzle	Pressure boundary	Copper alloy	Air (external)	None	None			G
	Pressure boundary Flow control	Copper alloy	Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	D

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifice	Flow control	Carbon steel	Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	D
		Stainless steel	Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	D
Pipe/fittings	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	B

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping	Pressure boundary	Aluminum	Air (external)	None	None			F
			Exhaust gas (internal)	Loss of material	Fire protection			F
		Carbon steel	Air (external)	Cracking-fatigue	Fire protection			H
				Loss of material	Fire protection	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	Fire protection			H
				Loss of material	Fire protection	VII.H2.4-a	3.3.1-5	C
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	B
		Cast iron with enameline	Fresh raw water (internal)	Loss of material	Fire protection			F
			Soil (external)	Loss of material	Buried piping inspection	VII.H1.1-b	3.3.1-18	B
		Stainless steel	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	B

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
			Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (internal)	Loss of material	Fire protection	VII.H2.1-a	3.3.1-15	E
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	B
		Stainless steel	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-a	3.3.1-21	B

Table 3.3.2-2 Water Suppression Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Aluminum	Air (external)	None	None			F
			Fresh raw water (internal)	Loss of material	Fire protection			F
		Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
		Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
			Soil (external)	Loss of material	Buried piping inspection	VII.H1.1-b	3.3.1-18	D
		Copper alloy	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B
			Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (internal)	Loss of material	Fire protection	VII.H2.1-a	3.3.1-15	E
		Stainless steel	Air (external)	None	None			G
			Fresh raw water (internal)	Loss of material	Fire protection	VII.G.6-b	3.3.1-21	B

Table 3.3.2-3
Emergency Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-3 Emergency Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			301
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.4-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil analysis			J
			Outdoor air (internal)	Cracking-fatigue	Periodic surveillance and preventive maintenance			301
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
						VII.I.2-a	3.3.1-24	E
				Loss of mechanical closure integrity	Bolting and torquing activities	VII.I.2-b	3.3.1-24	E
			Lube oil (external)	Loss of material	Oil analysis			G
				Loss of mechanical closure integrity	Bolting and torquing activities			G
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
			Lube oil (external)	Loss of material	Oil analysis			F
				Loss of mechanical closure integrity	Bolting and torquing activities			F

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Booster housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H2.2-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil analysis			J
			Untreated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	C
Distributor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H2.2-a	3.3.1-5	C
			Untreated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	C
Ejector	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			J

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			301
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.4-a	3.3.1-5	A
		Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
			Outdoor air (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
		Stainless steel	Air (external)	None	None			J

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint (continued)	Pressure boundary	Stainless steel	Exhaust gas (internal)	Cracking	Periodic surveillance and preventive maintenance			J
				Cracking-fatigue	TLAA-metal fatigue			J
			Exhaust gas (internal)	Loss of material	Periodic surveillance and preventive maintenance			J
Filter	Filtration	Carbon steel	Lube oil (internal)	Loss of material	Oil analysis			G
		Stainless steel	Lube oil (internal)	Loss of material	Oil analysis			F
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Periodic surveillance and preventive maintenance			F

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			F
			Outdoor air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	C

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
			Treated water (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
			Untreated air (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Governor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			J
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-b	3.3.1-17	E
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell) (continued)	Pressure boundary	Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
Heat exchanger (tubes)	Heat transfer	Copper alloy	Fresh raw water (internal)	Fouling	Service water integrity	VII.C1.3-b	3.3.1-17	305, B
			Lube oil (external)	Fouling	Service water integrity			G
			Treated water (external)	Fouling	Service water integrity	VII.C1.3-b	3.3.1-17	305, B
					Water chemistry control	VII.C1.3-b	3.3.1-17	305, E
		Copper with aluminum fin	Outdoor air (external)	Fouling	Periodic surveillance and preventive maintenance			J

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Heat transfer	Copper with aluminum fin	Treated water (internal)	Fouling	Periodic surveillance and preventive maintenance			J
					Water chemistry control			J
	Pressure boundary	Copper alloy	Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.3-a VII.C1.3-a	3.3.1-17 3.3.1-29	E
			Lube oil (external)	Loss of material	Oil analysis			G
				Loss of material-wear	Heat exchanger monitoring			G
			Treated water (external)	Loss of material	Water chemistry control	VII.C1.3-a VII.C1.3-a	3.3.1-17 3.3.1-29	E
				Loss of material-wear	Heat exchanger monitoring			H
		Copper with aluminum fin	Outdoor air (external)	Loss of material-wear	Periodic surveillance and preventive maintenance			J
			Treated water (internal)	Loss of material	Water chemistry control			J

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubesheet)	Pressure boundary	Copper alloy	Air (external)	None	None			G
			Fresh raw water (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.3-a VII.C1.3-a	3.3.1-17 3.3.1-29	E
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			J
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D
Orifice	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
	Pressure boundary Flow control	Carbon steel	Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Wall thinning monitoring	VII.H2.4-a	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	A

Table 3.3.2-3 Emergency Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping (continued)	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E
					Water chemistry control	VII.H2.1-a	3.3.1-15	D
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	A
		Copper alloy	Air (external)	None	None			G
		Copper alloy	Untreated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
		Stainless steel	Air (external)	None	None			G
			Treated water (internal)	Cracking	Water chemistry control			H
				Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	D

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D
Silencer	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H2.3-a	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Wall thinning monitoring	VII.H2.4-a	3.3.1-5	A
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Wall thinning monitoring	VII.H2.2-a	3.3.1-5	A

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Copper alloy	Air (external)	None	None			301
			Lube oil (internal)	Loss of material	Oil analysis			J
			Outdoor air (internal)	None	None			301
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			301
		Stainless steel	Air (external)	None	None			301
			Lube oil (internal)	Loss of material	Oil analysis			J
			Treated water (internal)	Cracking	Water chemistry control			301
			Treated water (internal)	Loss of material	Water chemistry control			301

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E
					Water chemistry control	VII.H2.1-a	3.3.1-15	D
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	A
		Copper alloy	Air (external)	None	None			G
			Lube oil (internal)	Loss of material	Oil analysis			G

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing (continued)	Pressure boundary	Copper alloy	Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
					Water chemistry control			G
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Periodic surveillance and preventive maintenance			G
		Stainless steel	Air (external)	None	None			G
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Cracking	Water chemistry control			G
				Loss of material	Water chemistry control			G

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Unloader	Pressure boundary	Copper alloy	Air (external)	None	None			301
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Periodic surveillance and preventive maintenance			J
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.4-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-3 Emergency Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Carbon steel	Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	A
		Cast iron	Lube oil (internal)	Loss of material	Oil analysis			G
		Cast iron	Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E
					Water chemistry control	VII.H2.1-a	3.3.1-15	D
		Copper alloy	Air (external)	None	None			F
			Lube oil (internal)	Loss of material	Oil analysis			F
			Outdoor air (internal)	None	None			F

Table 3.3.2-3 Emergency Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Copper alloy	Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
					Water chemistry control			F
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Periodic surveillance and preventive maintenance			F
		Stainless steel	Air (external)	None	None			G
			Treated water (internal)	Cracking	Water chemistry control			H
				Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	B
			Untreated air (internal)	Cracking-fatigue	TLAA-metal fatigue			G
			Untreated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-4
Alternate AC Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-4 Alternate AC Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Air motor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	C
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.H2.3-a	3.3.1-5	C
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			301
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.4-a	3.3.1-5	C
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Blower housing (continued)	Pressure boundary	Carbon steel	Outdoor air (internal)	Cracking-fatigue	TLAA-metal fatigue			301
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Bolting and torquing activities	VII.I.2-b	3.3.1-24	E
			Lube oil (external)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Bolting and torquing activities	VII.I.2-b	3.3.1-24	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
			Lube oil (external)	Loss of material	Oil analysis			F

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
				Cracking	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
			Outdoor air (internal)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
				Cracking	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Wall thinning monitoring			J
			Treated water (internal)	Cracking	Water chemistry control			301
				Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	D
Filter	Filtration	Carbon steel	Lube oil (internal)	Loss of material	Oil analysis			G
		Copper alloy	Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
		Stainless steel	Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			F

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Aluminum	Air (external)	None	None			F
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
		Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (internal)	Loss of material	System walkdown	VII.H2.3-a	3.3.1-5	C
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	C

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
				Cracking	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
			Lube oil (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
			Treated water (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			301
Governor housing	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			301
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Carbon steel with aluminum fin	Outdoor air (external)	Fouling	Periodic surveillance and preventive maintenance			J
			Treated water (internal)	Fouling	Periodic surveillance and preventive maintenance			J
		Copper alloy	Lube oil (external)	Fouling	Periodic surveillance and preventive maintenance			G
			Outdoor air (external)	Fouling	Periodic surveillance and preventive maintenance			G
			Treated water (internal)	Fouling	Periodic surveillance and preventive maintenance			G

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes) (continued)	Pressure boundary	Carbon steel with aluminum fin	Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	302, A
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	302, E
		Copper alloy	Lube oil (external)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material-wear	Periodic surveillance and preventive maintenance			G
			Treated water (internal)	Loss of material	Water chemistry control			G
Heater housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			301
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Indicator housing	Pressure boundary	Glass	Air (external)	None	None			J
			Treated water (internal)	None	None			J
Lubricator housing	Pressure boundary	Copper alloy	Air (external)	None	None			J
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			J
Orifice	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			301
			Treated water (internal)	Cracking	Water chemistry control			G
				Loss of material	Water chemistry control			G
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Wall thinning monitoring	VII.H2.4-a	3.3.1-5	A

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	B
		Stainless steel	Air (external)	None	None			G
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D
		Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Silencer	Pressure boundary	Carbon steel	Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Wall thinning monitoring	VII.H2.4-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	A
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Periodic surveillance and preventive maintenance			J

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Thermowell (continued)	Pressure boundary	Stainless steel	Lube oil (internal)	Cracking	Oil analysis			J
				Loss of material	Oil analysis			J
			Outdoor air (external)	None	None			301
			Outdoor air (internal)	None	None			301
			Treated water (internal)	Cracking	Water chemistry control			301
			Treated water (internal)	Loss of material	Water chemistry control			301
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			G
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	B

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Lube oil (internal)	Cracking	Oil analysis			G
				Loss of material	Oil analysis			G
			Outdoor air (external)	None	None			G
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
			Treated water (internal)	Cracking	Water chemistry control			G
				Loss of material	Water chemistry control			G

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Exhaust gas (internal)	Cracking-fatigue	TLAA-metal fatigue			H
				Loss of material	Periodic surveillance and preventive maintenance	VII.H2.4-a	3.3.1-5	C
			Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Outdoor air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.3-a	3.3.1-5	C
			Treated water (internal)	Loss of material	Water chemistry control	VII.H2.1-a	3.3.1-15	D

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.1-a	3.3.1-15	E
					Water chemistry control	VII.H2.1-a	3.3.1-15	D
		Copper alloy	Air (external)	None	None			F
			Lube oil (internal)	Loss of material	Oil analysis			301
			Outdoor air (external)	Loss of material	System walkdown			F
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			F

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Copper alloy	Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
					Water chemistry control			F
		Stainless steel	Air (external)	None	None			301
			Lube oil (internal)	Cracking	Oil analysis			G
			Lube oil (internal)	Loss of material	Oil analysis			G
			Outdoor air (external)	None	None			G
			Outdoor air (internal)	None	None			G
			Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-4 Alternate AC Diesel Generator System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Cracking	Water chemistry control			H
				Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	B
	Pressure boundary Flow control	Carbon steel	Treated air (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.H2.2-a	3.3.1-5	A

Table 3.3.2-5
Chemical and Volume Control System
Summary of Aging Management Evaluation

Table 3.3.2-5 Chemical & Volume Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention	VII.E1.1-b VII.E1.2-a VII.E1.3-b VII.E1.4-a VII.E1.5-b VII.E1.6-a	3.3.1-14	A
					System walkdown	VII.I.1-b	3.3.1-5	A
				Loss of mechanical closure integrity	Boric acid corrosion prevention			H
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F

Table 3.3.2-5 Chemical & Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Gear housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			301
Heat exchanger (shell)	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water >270°F (internal)	Cracking	Water chemistry control	VII.E1.7-c	3.3.1-9	A
				Cracking-fatigue	TLAA-metal fatigue	VII.E1.7-a	3.3.1-3	B
				Loss of material	Water chemistry control			H
Piping	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated borated water (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Loss of material	Water chemistry control			G
			Treated borated water >270°F (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Cracking-fatigue	TLAA-metal fatigue	VII.E1.1-a	3.3.1-3	B
				Loss of material	Water chemistry control			H
			Treated water (internal)	Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	D

Table 3.3.2-5 Chemical & Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	A
				Cracking-fatigue	Periodic surveillance and preventive maintenance			H
				Loss of material	Water chemistry control			H
				Loss of material-wear	Periodic surveillance and preventive maintenance			H
Sight glass	Pressure boundary	Glass	Air (external)	None	None			J
			Lube oil (internal)	None	None			J
Sight glass (housing)	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Lube oil (internal)	Cracking	Oil analysis			J
				Loss of material	Oil analysis			J

Table 3.3.2-5 Chemical & Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Treated borated water (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Loss of material	Water chemistry control			301
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Treated borated water >270°F (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
			Treated borated water >270°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VII.E1.1-a	3.3.1-3	D
				Loss of material	Water chemistry control			301

Table 3.3.2-5 Chemical & Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis			F
		Stainless steel	Air (external)	None	None			G
			Lube oil (internal)	Cracking	Oil analysis			G
				Loss of material	Oil analysis			G
			Nitrogen (internal)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Cracking-fatigue	TLAA-metal fatigue	VII.E1.1-a	3.3.1-3	B
				Loss of material	Water chemistry control			H
			Treated water (internal)	Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	D

Table 3.3.2-5 Chemical & Volume Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Stainless steel	Air (external)	None	None			G
			Lube oil (internal)	Cracking	Oil analysis			G
				Loss of material	Oil analysis			G
			Nitrogen (internal)	None	None			G
			Treated borated water (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Loss of material	Water chemistry control			H
			Treated borated water >270°F (internal)	Cracking	Water chemistry control	VII.E1.5-a	3.3.1-4	C
				Cracking-fatigue	TLAA-metal fatigue	VII.E1.3-a	3.3.1-3	B
				Loss of material	Water chemistry control			H
			Treated water (internal)	Loss of material	Water chemistry control	VII.C2.2-a	3.3.1-15	A

Table 3.3.2-6
Halon Fire Protection and RCP Motor Oil Leakage Collection System
Summary of Aging Management Evaluation

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	VII.I.1-a	3.3.1-14	A
				Loss of mechanical closure integrity	Boric acid corrosion prevention			H
		Stainless steel	Air (external)	None	None			F
			Untreated borated water (external)	None	None			F
Flex hose	Pressure boundary	SS braid, teflon liner	Air (external)	None	None			J
			Halon 1301 (internal)	None	None			J
			Nitrogen (internal)	None	None			J

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Indicator housing	Pressure boundary	Glass	Air (external)	None	None			J
			Lube oil (internal)	None	None			J
Nozzle	Pressure boundary	Aluminum	Air (external)	None	None			F
			Halon 1301 (internal)	None	None			F
			Nitrogen (internal)	None	None			F
Pan	Pressure boundary	Carbon steel	Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			J
		Stainless steel	Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance			J
			Untreated borated water (external)	Loss of material	Periodic surveillance and preventive maintenance			J

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	Periodic surveillance and preventive maintenance			G
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.G.7-b	3.3.1-6	A
			Nitrogen (internal)	None	None			G
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	VII.I.1-a	3.3.1-14	A
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
			Halon 1301 (internal)	None	None			G
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.G.7-a	3.3.1-6	A
			Nitrogen (internal)	None	None			G
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	VII.I.1-a	3.3.1-14	A
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.G.7-b	3.3.1-6	A
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	VII.I.1-a	3.3.1-14	A
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Brass	Air (external)	None	None			G
			Halon 1301 (internal)	None	None			G
			Nitrogen (internal)	None	None			G
		Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	A
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.G.7-b	3.3.1-6	A
			Untreated borated water (external)	Loss of material	Boric acid corrosion prevention	VII.I.1-a	3.3.1-14	A
			Untreated borated water (internal)	Loss of material	Periodic surveillance and preventive maintenance			G

Table 3.3.2-6 Halon Fire Protection and RCP Motor Oil Collection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Cast bronze	Air (external)	None	None			G
			Halon 1301 (internal)	None	None			G
			Nitrogen (internal)	None	None			G

Table 3.3.2-7
Fuel Oil System
Summary of Aging Management Evaluation

Table 3.3.2-7 Fuel Oil System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H1.2-a VII.H1.3-a VII.I.1-b	3.3.1-5	A
						VII.I.2-a	3.3.1-24	E
				Loss of mechanical closure integrity	Bolting and torquing activities	VII.I.2-b	3.3.1-24	E
			Outdoor air (external)	Loss of material	System walkdown	VII.H1.2-a VII.H1.3-a VII.I.1-b	3.3.1-5	A
						VII.I.1.2-a	3.3.1-24	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
Filter	Filtration	Stainless steel	Fuel oil (internal)	Cracking	Diesel fuel monitoring			F
				Loss of material	Diesel fuel monitoring			F

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	C
			Outdoor air (external)	Loss of material	System walkdown	VII.H1.1-a	3.3.1-5	C
		Cast iron	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	C
Flame arrestor	Flow control	Aluminum	Outdoor air (external)	None	None			J
			Outdoor air (internal)	None	None			J

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flex hose	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
				Cracking	Periodic surveillance and preventive maintenance	VII.F4.1-b	3.3.1-2	C
			Fuel oil (internal)	Change in material properties	Periodic surveillance and preventive maintenance			J
				Cracking	Periodic surveillance and preventive maintenance			J
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	C

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Carbon steel with aluminum fin	Air (external)	Fouling	Periodic surveillance and preventive maintenance			J
			Fuel oil (internal)	Fouling	Periodic surveillance and preventive maintenance			J
	Pressure boundary	Carbon steel with aluminum fin	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	302, A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	302, C
Indicator housing	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring			J
Injector housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.I.1-b	3.3.1-5	C
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	C
			Lube oil (external)	Loss of material	Oil analysis			301

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			G
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring			G
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H1.1-a	3.3.1-5	A
			Air (internal)	Loss of material	Periodic surveillance and preventive maintenance			301
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	D
			Outdoor air (external)	Loss of material	System walkdown	VII.H1.1-a	3.3.1-5	A
			Soil (external)	Loss of material	Buried piping inspection	VII.H1.1-b	3.3.1-18	A
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H1.3-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	D
		Cast iron	Air (external)	Loss of material	System walkdown	VII.H1.3-a	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	D

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.H1.4-b	3.3.1-23	E
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H1.4-a VII.H2.5-a	3.3.1-7	B
					Periodic surveillance and preventive maintenance	VII.H1.4-a VII.H2.5-a	3.3.1-7	E
			Outdoor air (external)	Loss of material	System walkdown	VII.H1.4-b	3.3.1-23	E
			Sand and concrete (external)	Loss of material	Periodic surveillance and preventive maintenance			G
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			301
			Fuel oil (internal)	Cracking	Diesel fuel monitoring			J
				Loss of material	Diesel fuel monitoring			J

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	D
			Lube oil (external)	Loss of material	Oil analysis			G
		Copper alloy	Air (external)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring			F
		Stainless steel	Air (external)	None	None			F
			Fuel oil (internal)	Cracking	Diesel fuel monitoring			F
				Loss of material	Diesel fuel monitoring			F

Table 3.3.2-7 Fuel Oil System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring	VII.H2.5-a	3.3.1-7	D
			Outdoor air (external)	Loss of material	System walkdown	VII.H1.2-a	3.3.1-5	A
		Copper alloy	Air (external)	None	None			F
			Fuel oil (internal)	Loss of material	Diesel fuel monitoring			F
			Outdoor air (external)	Loss of material	System walkdown			F
		Stainless steel	Air (external)	None	None			F
			Fuel oil (internal)	Cracking	Diesel fuel monitoring			F
				Loss of material	Diesel fuel monitoring			F
			Outdoor air (external)	None	None			F

Table 3.3.2-8
Service Water System
Summary of Aging Management Evaluation

Table 3.3.2-8 Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Outdoor air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Bolting	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (external)	Loss of material	Periodic surveillance and preventive maintenance			G
					Service water integrity			G
			Outdoor air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A

Table 3.3.2-8 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (continued)	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			F
			Fresh raw water (external)	Loss of material	Periodic surveillance and preventive maintenance			F
					Service water integrity			F
Damper housing	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Outdoor air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Ductwork	Pressure boundary	Carbon steel	Outdoor air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Outdoor air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Expansion joint	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			301
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	D

Table 3.3.2-8 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter	Filtration	Stainless steel	Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.6-a	3.3.1-17	E
					Service water integrity	VII.C1.6-a	3.3.1-17	D
Filter housing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.6-a	3.3.1-17	B
		Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.6-a	3.3.1-17	B
Flow straightener	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			301
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.4-a	3.3.1-17	D

Table 3.3.2-8 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Orifice	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.4-a	3.3.1-17	B
	Pressure boundary Flow control	Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.4-a	3.3.1-17	B
Piping	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	B
			Soil (external)	Loss of material	Buried piping inspection	VII.C1.1-b	3.3.1-18	B
		Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Cracking	Service water integrity			H
				Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	B

Table 3.3.2-8 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.5-a	3.3.1-17	E
			Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.5-a	3.3.1-17	E
		Stainless steel	Fresh raw water (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.1-a	3.3.1-17	E
			Fresh raw water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.C1.1-a	3.3.1-17	E
Thermowell	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			301
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	D

Table 3.3.2-8 Service Water System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	B
	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Cracking	Service water integrity			H
				Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	B
Valve	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.2-a	3.3.1-17	B
		Cast iron	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (external)	Loss of material	Service water integrity	VII.C1.2-a VII.C1.2-a	3.3.1-17 3.3.1-29	B
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.2-a VII.C1.2-a	3.3.1-17 3.3.1-29	B

Table 3.3.2-8 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			G
			Fresh raw water (internal)	Cracking	Service water integrity			H
				Loss of material	Service water integrity	VII.C1.2-a	3.3.1-17	B

Table 3.3.2-9
Auxiliary Building Ventilation System
Summary of Aging Management Evaluation

Table 3.3.2-9 Auxiliary Building Ventilation System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
Cooling coil housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F2.1-a	3.3.1-5	A
			Outdoor air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A

Table 3.3.2-9 Auxiliary Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Damper housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	A
Expansion joint	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F2.1-b	3.3.1-2	A
			Air (external)	Cracking	Periodic surveillance and preventive maintenance	VII.F2.1-b	3.3.1-2	A
			Air (internal)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F2.1-b	3.3.1-2	A
				Cracking	Periodic surveillance and preventive maintenance	VII.F2.1-b	3.3.1-2	A

Table 3.3.2-9 Auxiliary Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper alloy	Condensation (external)	Fouling	Periodic surveillance and preventive maintenance			H
			Fresh raw water (internal)	Fouling	Periodic surveillance and preventive maintenance			H
					Service water integrity			H
	Pressure boundary	Copper alloy	Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.F2.2-a	3.3.1-5	A
				Loss of material-wear	Periodic surveillance and preventive maintenance			H
			Freon (internal)	None	None			G
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	D

Table 3.3.2-9 Auxiliary Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	C
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Condensation (external)	Loss of material	System walkdown	VII.F2.2-a	3.3.1-5	C
			Freon (internal)	None	None			F
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F2.1-a	3.3.1-5	C

Table 3.3.2-10
Control Room Ventilation System
Summary of Aging Management Evaluation

Table 3.3.2-10 Control Room Ventilation System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Blower housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
		Stainless steel	Air (external)	None	None			F
Compressor casing	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Freon (internal)	None	None			J
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance			301

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cooling coil housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F1.1-a	3.3.1-5	A
Damper housing	Pressure boundary	Aluminum	Air (external)	None	None			F
			Air (internal)	None	None			F
		Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
Ductwork	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	A

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion joint	Pressure boundary	Elastomer	Air (external)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F1.1-b	3.3.1-2	A
				Cracking	Periodic surveillance and preventive maintenance	VII.F1.1-b	3.3.1-2	A
			Air (internal)	Change in material properties	Periodic surveillance and preventive maintenance	VII.F1.1-b	3.3.1-2	A
				Cracking	Periodic surveillance and preventive maintenance	VII.F1.1-b	3.3.1-2	A

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.4-a	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F1.4-a	3.3.1-5	A
		Copper alloy	Condensation (external)	Loss of material	System walkdown	VII.F1.2-a	3.3.1-5	C
			Freon (internal)	None	None			F
		Stainless steel	Air (external)	None	None			303, I
			Air (internal)	None	None			303, I
Heat exchanger (bonnet)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	C
Heat exchanger (shell)	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Freon (internal)	None	None			G

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubes)	Heat transfer	Copper alloy	Air (external)	Fouling	Periodic surveillance and preventive maintenance			H
			Freon (external)	None	None			G
			Freon (internal)	None	None			G
			Fresh raw water (internal)	Fouling	Service water integrity			H
			Condensation (external)	Loss of material	Periodic surveillance and preventive maintenance	VII.F1.2-a	3.3.1-5	A
			Freon (external)	None	None			G
			Freon (internal)	None	None			G
			Fresh raw water (internal)	Loss of material	Service water integrity	VII.C1.1-a	3.3.1-17	C

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Indicator housing	Pressure boundary	Copper alloy	Condensation (external)	Loss of material	System walkdown			301
			Freon (internal)	None	None			J
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F1.1-a	3.3.1-5	C
Sight glass	Pressure boundary	Glass	Air (external)	None	None			J
			Condensation (internal)	None	None			J
Sight glass (housing)	Pressure boundary	Copper alloy	Air (external)	None	None			301
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance			301
Silencer	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	C
			Air (internal)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	C
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Carbon dioxide (internal)	None	None			G

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VII.I.1-b	3.3.1-5	A
			Air (internal)	Loss of material	System walkdown	VII.F1.1-a	3.3.1-5	C
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Carbon dioxide (internal)	None	None			F
			Condensation (external)	Loss of material	System walkdown	VII.F1.2-a	3.3.1-5	C
			Freon (internal)	None	None			F
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
		Stainless steel	Air (external)	None	None			F
			Condensation (internal)	Loss of material	Periodic surveillance and preventive maintenance	VII.F1.4-a	3.3.1-5	C

Table 3.3.2-10 Control Room Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Air (internal)	None	None			F
			Carbon dioxide (internal)	None	None			F
			Condensation (external)	Loss of material	System walkdown	VII.F1.2-a	3.3.1-5	C
			Freon (internal)	None	None			F
			Lube oil (internal)	Loss of material	Periodic surveillance and preventive maintenance			F
		Stainless steel	Air (external)	None	None			G
			Carbon dioxide (internal)	None	None			G

Table 3.3.2-11
Miscellaneous Systems in Scope for 10CFR54.4(a)(2)
Summary of Aging Management Evaluation

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	Boric acid corrosion prevention			304
				Loss of mechanical closure integrity	Bolting and torquing activities			
					Boric acid corrosion prevention			
Bolting Filter housing Piping Valve	Pressure boundary	Carbon steel	Condensation (external)	Loss of material	System walkdown			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bolting Filter housing Heat exchanger (shell, channel head) Orifice Piping Pump casing Tank Thermowell Valve Ventilation unit housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown			304
Bolting	Pressure boundary	Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Bolting Filter housing Heat exchanger (shell, channel head) Orifice Piping Pump casing Tank Thermowell Tubing Valve	Pressure boundary	Stainless steel	Air (external)	None	None			304
Bolting Piping	Pressure boundary	Stainless steel	Condensation (external)	Loss of material	System walkdown			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing Orifice Piping Pump casing Tank Thermowell Tubing Valve	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			
Filter housing Orifice Piping Pump casing Tank Valve	Pressure boundary	Stainless steel	Treated borated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Filter housing Heat exchanger (shell, channel head) Heat exchanger (heating or cooling coil not enclosed in housing) Orifice Piping Pump casing Tank Thermowell Tubing Valve	Pressure boundary	Stainless steel	Treated borated water > 140 °F (internal)	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking	System walkdown			
					Water chemistry control			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing Orifice Piping Pump casing Tank Tubing Valve	Pressure boundary	Stainless steel	Untreated water (internal)	Loss of material	System walkdown			304
Filter housing Piping Tubing	Pressure boundary	Stainless steel	Untreated water (internal) > 140 °F	Loss of material	System walkdown			304
				Cracking	System walkdown			
Filter housing Piping Pump casing Tubing	Pressure boundary	Stainless steel	Untreated borated water > 140 °F (internal)	Loss of material	System walkdown			304
				Cracking	System walkdown			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing Orifice Piping Valve	Pressure boundary	Carbon steel	Treated water or steam > 220 °F (internal)	Cracking – fatigue	System walkdown			304
				Loss of material	System walkdown			
					Water chemistry control			
				Loss of material – erosion	Flow-accelerated corrosion			
Filter housing Heat exchanger (shell, channel head) Orifice Piping Pump casing Tank Thermowell Valve	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Filter housing	Pressure boundary	Copper alloy	Air	None	None			304
			Condensation	Loss of material	System walkdown			304
Filter housing Tubing Valve	Pressure boundary	Copper alloy	Fresh raw water (internal)	Loss of material	System walkdown			304
Heat exchanger (shell, channel head) Piping Pump casing Thermowell Tubing	Pressure boundary	Stainless steel	Treated borated water > 270 °F (internal)	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking	System walkdown			
					Water chemistry control			
				Cracking-fatigue	System walkdown			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Heat exchanger (shell, head channel) Piping Pump casing Tubing Valve	Pressure boundary	Stainless steel	Treated water (internal) > 140 °F	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking	System walkdown			
					Water chemistry control			
Heat exchanger (shell, head channel) Orifice Piping Pump casing Tank Tubing Valve	Pressure boundary	Stainless steel	Untreated borated water (internal)	Loss of material	System walkdown			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (shell, channel head) Heat exchanger (heating or cooling coil not enclosed in housing) Piping Valve	Pressure boundary	Copper alloy	Air (external)	None	None			304
			Condensation (external)	Loss of material	System walkdown			304
			Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			
Level glass gauge	Pressure boundary	Glass	Air (external)	None	None			304
			Fresh raw water (internal)	None	None			304
Orifice Piping Pump casing Thermowell Valve	Pressure boundary	Carbon steel	Fresh raw water (internal)	Loss of material	System walkdown			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Orifice Piping Thermowell Tubing Valve	Pressure boundary	Stainless steel	Fresh raw water (internal)	Loss of material	System walkdown			304
Orifice Tubing Valve	Pressure boundary	Stainless steel	Treated water or steam >270 °F (internal)	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking	System walkdown			
					Water chemistry control			
				Cracking (fatigue)	System walkdown			
Piping Pump casing Valve	Pressure boundary	Carbon steel	Untreated water (internal)	Loss of material	System walkdown			304

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG 1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping Tubing Valve	Pressure boundary	Copper alloy	Untreated water (internal)	Loss of material	System walkdown			304
Piping	Pressure boundary	Stainless steel	Sodium hydroxide	Loss of material	System walkdown			304
				Cracking	System walkdown			
			Hydrazine or ammonia	Loss of material	System walkdown			304
				Cracking	System walkdown			
Pump casing	Pressure boundary	Carbon steel with stainless clad on internal surfaces	Air (external)	Loss of material	System walkdown			304
			Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking (of cladding)	System walkdown			
					Water chemistry control			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing Valve	Pressure boundary	Stainless steel	Sodium hydroxide (internal)	Loss of material	System walkdown			304
				Cracking	System walkdown			
Tank	Pressure boundary	Carbon steel	Steam or treated water > 220 °F (internal)	Loss of material	System walkdown			304
					Water chemistry control			
				Cracking-fatigue	System walkdown			
		Carbon steel (coated)	Air (external)	Loss of material	System walkdown			304
			Untreated borated water (internal)	Loss of material	System walkdown			304
Tubing	Pressure boundary	Copper alloy	Air (external)	None	None			304
			Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			

Table 3.3.2-11 Miscellaneous Systems in Scope for 10CFR54.4(a)(2) (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG 1801 Vol. 2 Item	Table 1 Item	Notes
Valve	Pressure boundary	Aluminum	Condensation (external)	Loss of material	System walkdown			304
			Treated water (internal)	Loss of material	System walkdown			304
					Water chemistry control			
		Stainless steel	Hydrazine or ammonia (internal)	Loss of material	System walkdown			304
				Cracking	System walkdown			
			Untreated water > 270 °F (internal)	Cracking	System walkdown			304
				Cracking-fatigue	System walkdown			
				Loss of material	System walkdown			
Ventilation unit housings	Pressure boundary	Carbon steel	Condensation (internal)	Loss of material	System walkdown			304

3.4 STEAM AND POWER CONVERSION SYSTEMS

3.4.1 Introduction

This section provides the results of the aging management reviews for components in the steam and power conversion systems that are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- main steam system (Section 2.3.4.1)
- main feedwater system (Section 2.3.4.2)
- emergency feedwater system (Section 2.3.4.3)

Table 3.4.1, Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the steam and power conversion system component group. This table uses the format described in the introduction to Section 3. Hyperlinks to the program evaluations in Appendix B are provided.

3.4.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for the steam and power conversion systems.

- Table 3.4.2-1 Main Steam System - Summary of Aging Management Evaluation
- Table 3.4.2-2 Main Feedwater System - Summary of Aging Management Evaluation
- Table 3.4.2-3 Emergency Feedwater System - Summary of Aging Management Evaluation

3.4.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the steam and power conversion systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.4.2.1.1 Main Steam System

Materials

Main steam system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Main steam system components are exposed to the following environments.

- air
- steam > 270 °F
- treated water > 270°F
- treated water > 220°F

Aging Effects Requiring Management

The following aging effects associated with the main steam system require management.

- cracking
- cracking – fatigue
- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on main steam system components.

- bolting and torquing activities
- flow-accelerated corrosion
- system walkdown
- water chemistry control

3.4.2.1.2 Main Feedwater System

Materials

Main feedwater system components are constructed of the following materials.

- carbon steel
- stainless steel

Environment

Main feedwater system components are exposed to the following environments.

- air
- treated water > 270°F

- treated water > 220°F

Aging Effects Requiring Management

The following aging effects associated with the main feedwater system require management.

- cracking
- cracking - fatigue
- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on main feedwater system components.

- bolting and torquing activities
- flow-accelerated corrosion
- system walkdown
- water chemistry control

3.4.2.1.3 Emergency Feedwater System

Materials

Emergency feedwater system components are constructed of the following materials.

- carbon steel
- cast iron
- copper
- copper alloy
- glass
- stainless steel

Environment

Emergency feedwater system components are exposed to the following environments.

- air
- outdoor air

- lube oil
- steam > 220°F
- steam > 270°F
- treated water
- treated water > 220°F

Some emergency feedwater system components are exposed to outdoor environments. For NUREG-1801 line items, indoor and outdoor air have been treated the same.

Treated water or steam at temperatures greater than 270°F may cause cracking due to fatigue in stainless steel components. Although the NUREG-1801 line item for fatigue lists a lower temperature threshold it was still referenced in the system/component tables.

Aging Effects Requiring Management

The following aging effects associated with the emergency feedwater system require management.

- cracking
- cracking - fatigue
- fouling
- loss of material
- loss of mechanical closure integrity

Aging Management Programs

The following programs manage the effects of aging on emergency feedwater system components.

- bolting and torquing activities
- flow-accelerated corrosion
- oil analysis
- periodic surveillance and preventive maintenance
- system walkdown
- water chemistry control

3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant specific programs or that involve TLAAs. Section

3.4.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the ANO-2 approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.4.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10CFR54.3. TLAAs must be evaluated in accordance with 10CFR54.21(c). The evaluation of this TLAA is addressed in Section 4.3 of this application.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

This paragraph of NUREG-1800 repeats the NUREG-1801 recommendation for further evaluation to verify the effectiveness of the water chemistry control program in managing loss of material due to general, pitting, and crevice corrosion. For the components for which this evaluation is required, the water chemistry program minimizes loss of material. The periodic surveillance and preventive maintenance program supplements water chemistry control for portions of the emergency feedwater system. The water chemistry control program provides for the inspection of systems when they are opened for maintenance, which addresses the one time inspection recommendation in NUREG-1801. Aging management programs are described in Appendix B.

3.4.2.2.3 Loss of Material due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

This paragraph of NUREG-1800 discusses loss of material in carbon steel piping and fittings for untreated water from the backup water supply in a PWR auxiliary feedwater system. The portion of the lines from the service water (SW) system to the emergency feedwater system that are exposed to untreated water are addressed as part of the SW system (Item Number 3.3.1-17 of Table 3.3.1). With exceptions, the service water integrity program is the equivalent of the open cycle cooling system program described in NUREG-1801. The service water integrity program supplemented by the water chemistry control and periodic surveillance and preventive maintenance programs manage loss of material and fouling. Although biofouling is not, in itself, an aging effect, the programs manage the effects which may result from biofouling.

3.4.2.2.4 General Corrosion

Loss of material due to general corrosion could occur on external surfaces of carbon steel structures and components, including closure bolting. This aging effect is managed by the system walkdown program for exposed carbon steel components and bolting indoors and outdoors.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

1. Loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC could occur in stainless steel and carbon steel components exposed to lubricating oil in the emergency feedwater system. The oil analysis program manages loss of material.

2. This paragraph of NUREG-1800, which discusses loss of material in underground piping and fittings and storage tanks, is not applicable. There are no buried components in steam and power conversion systems.

3.4.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10CFRPart 50, Appendix B. Corrective actions for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 corrective action program. Administrative control for both safety-related and nonsafety-related structures and components is accomplished per the existing ANO-2 document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.4.2.3 Time-Limited Aging Analyses

The only TLAA identified for the steam and power conversion systems components is metal fatigue. This is evaluated in Section 4.3 of this application.

3.4.3 Conclusion

The steam and power conversion system components that are subject to aging management review have been identified in accordance with the requirements of 10CFR54.21. The aging management programs selected to manage aging effects for the steam and power conversion system components are identified in the following tables.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging on steam and power conversion system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.4.1
Summary of Aging Management Programs for the Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801

Table 3.4.1: Steam and Power Conversion System, NUREG 1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-1	Piping and fittings in main feedwater line, steam line and auxiliary feedwater (AFW) piping (PWR only)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.4.2.2.1)	Consistent with NUREG-1801. This TLAA is further evaluated in Section 4.3.
3.4.1-2	Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry and one-time inspection	Yes, detection of aging effects is to be further evaluated (see NUREG-1800 Subsection 3.4.2.2.2)	Consistent with NUREG-1801. The water chemistry control program is credited with managing this aging effect. The periodic surveillance and preventive maintenance program supplements water chemistry control for the emergency feedwater system. The water chemistry control program provides for the inspection of systems when they are opened for maintenance, which addresses the one-time inspection recommendation in NUREG-1801.

Table 3.4.1: Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-3	AFW piping	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.3)	The portion of the lines from the service water (SW) system to the emergency feedwater system that are exposed to untreated water are addressed as part of the SW system. For further evaluation, see Section 3.4.2.2.3
3.4.1-4	Oil coolers in AFW system (lubricating oil side possibly contaminated with water)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.5.1)	Consistent with NUREG-1801. The oil analysis program manages loss of material. For further evaluation, see Section 3.4.2.2.5
3.4.1-5	External surface of carbon steel components	Loss of material due to general corrosion	Plant specific	Yes, plant specific (see NUREG-1800 Subsection 3.4.2.2.4)	Consistent with NUREG-1801. System walkdown program is credited with managing this aging effect For further evaluation, see Section 3.4.2.2.4

Table 3.4.1: Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-6	Carbon steel piping and valve bodies	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	No	Consistent with NUREG-1801 for main feedwater and main steam. The flow-accelerated corrosion program will manage this aging effect. For the emergency feedwater system, flow-accelerated corrosion is an applicable aging mechanism only for the components within the steam turbine section since this portion of the system is the only portion subjected to high flow conditions. The flow-accelerated corrosion program will manage this aging effect for these portions of the emergency feedwater system.
3.4.1-7	Carbon steel piping and valve bodies in main steam system	Loss of material due to pitting and crevice corrosion	Water chemistry	No	Consistent with NUREG-1801. The water chemistry control program is credited with managing this aging effect

Table 3.4.1: Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.4.1-8	Closure bolting in high-pressure or high-temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC.	Bolting integrity	No	For this component, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item. Different programs than the NUREG-1801 bolting integrity program are used. The system walkdown program supplements bolting and torquing activities to maintain bolting integrity.
3.4.1-9	Heat exchangers and coolers/ condensers serviced by open-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	No	Not applicable. The only heat exchangers in scope for the steam and power conversion system are the emergency feedwater system lube oil coolers, which are cooled by the process fluid (condensate).
3.4.1-10	Heat exchangers and coolers/ condensers serviced by closed-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling water system	No	Not applicable. The only heat exchangers in scope for the steam and power conversion system are the emergency feedwater system lube oil coolers, which are cooled by the process fluid (condensate).

Table 3.4.1: Steam and Power Conversion System, NUREG 1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-11	External surface of aboveground condensate storage tank	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground carbon steel tanks	No	Not applicable. The condensate storage tank is stainless steel.
3.4.1-12	External surface of buried condensate storage tank and AFW piping	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	No Yes, detection of aging effects and operating experience are to be further evaluated (see NUREG-1800 Subsection 3.4.2.2.5.2)	Not applicable. There are no buried components within scope for the steam and power conversion system.
3.4.1-13	External surface of carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Not applicable. Components within scope for the steam and power conversion system are not exposed to leakage from systems containing boric acid.

Notes for Table 3.4.2-1 through 3.4.2-5

Generic notes

A. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, aging effect and aging management program. AMP has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 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

401. The material and environment combination is in NUREG-1801 but neither the plant component, nor a reasonable substitute, exists.

402. The NUREG-1801 environment of treated water is considered the same as treated water > 220F

Table 3.4.2-1
Main Steam System
Summary of Aging Management Evaluation

Table 3.4.2-1 Main Steam System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and torquing activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
Expansion joint	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Steam > 270°F (internal)	Cracking	Water chemistry control			J
			Steam > 270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Water chemistry control			J
Orifice	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220 (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Water chemistry control	VIII.B1.1-a	3.4.1-7	C

Table 3.4.2-1 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220 (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	B
			Steam > 220 (internal)	Loss of material	Flow-accelerated corrosion	VIII.B1.1-c	3.4.1-6	A
					Water chemistry control	VIII.B1.1-a	3.4.1-7	A
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Flow-accelerated corrosion			G
					Water chemistry control			G
		Stainless steel	Air (external)	None	None			F
			Steam > 270°F (internal)	Cracking	Water chemistry control			F
			Steam > 270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F

Table 3.4.2-1 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping (continued)	Pressure boundary	Stainless steel	Treated water > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F

Table 3.4.2-1 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steam trap	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Flow-accelerated corrosion	VIII.B1.1-c	3.4.1-6	C
					Water chemistry control	VIII.B1.1-a	3.4.1-7	C
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue			401
				Loss of material	Flow-accelerated corrosion			401
					Water chemistry control			401
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Steam > 270°F (internal)	Cracking	Water chemistry control			J
				Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Water chemistry control			J

Table 3.4.2-1 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Steam > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking - fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F
			Treated water > 220°F (internal)	Cracking	Water chemistry control			F
				Cracking - fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220 (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Flow-accelerated corrosion	VIII.B1.2-b	3.4.1-6	A
					Water chemistry control	VIII.B1.2-a	3.4.1-7	A

Table 3.4.2-1 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve (continued)	Pressure boundary	Carbon steel	Treated water > 220°F (F (internal)	Cracking-fatigue	TLAA-metal fatigue			G
				Loss of material	Flow-accelerated corrosion			G
					Water chemistry control			G
		Stainless steel	Air (external)	None	None			F
			Steam > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F

Table 3.4.2-2
Main Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-2 Main Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and torquing activities	VIII.H.2-b	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.D1.1-b	3.4.1-1	402, B
			Treated water > 220°F (internal)	Loss of material	Flow-accelerated corrosion	VIII.D1.1-a	3.4.1-6	402, A
					Water chemistry control	VIII.D1.1-c	3.4.1-2	402, A

Table 3.4.2-2 Main Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tubing	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Treated water > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.D1.1-b	3.4.1-1	D
				Loss of material	Flow-accelerated corrosion	VIII.D1.2-a	3.4.1-6	A
					Water chemistry control	VIII.D1.2-b	3.4.1-2	A
		Stainless steel	Air (external)	None	None			F
			Treated water > 270°F (internal)	Cracking	Water chemistry control			F
				Cracking-fatigue	TLAA-metal fatigue			F
				Loss of material	Water chemistry control			F

Table 3.4.2-3
Emergency Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-3 Emergency Feedwater System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Bearing housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	A
Bolting	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.2-a	3.4.1-8	E
				Loss of mechanical closure integrity	Bolting and torquing activities	VIII.H.2-b	3.4.1-8	E
			Outdoor air (external)	Loss of material	System walkdown	VIII.H.2-a	3.4.1-8	E
		Stainless steel	Air (external)	Loss of mechanical closure integrity	Bolting and torquing activities			F
				None	None			F
			Outdoor air (external)	None	None			F

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equalizer pipe	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
Filter housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
		Cast iron	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	oil analysis	VIII.G.5-d	3.4.1-4	C
Governor housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
Heat exchanger (tubes)	Heat transfer	Copper	Lube oil (external)	Fouling	Periodic surveillance and preventive maintenance			F
			Treated water (internal)	Fouling	Periodic surveillance and preventive maintenance			F
	Pressure boundary	Copper	Lube oil (external)	Loss of material	Oil analysis			F
			Treated water (internal)	Loss of material	Water chemistry control			F

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat exchanger (tubesheet)	Pressure boundary	Copper alloy	Air (external)	None	None			F
			Lube oil (internal)	Loss of material	Oil analysis			F
Heater housing	Pressure boundary	Stainless steel	Air (internal)	None	None			J
			Treated water (external)	Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C
Orifice	Pressure boundary Flow control	Stainless steel	Air (external)	None	None			J
			Lube oil (internal)	Cracking	Oil analysis			401
				Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Steam > 270°F (internal)	Cracking	Water chemistry control			J
			Steam > 270°F (internal)	Cracking-fatigue	TLAA-metal fatigue			J
				Loss of material	Water chemistry control			J
			Treated water (internal)	Cracking	Water chemistry control			401
				Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Steam >220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Flow-accelerated corrosion	VIII.B1.1-c	3.4.1-6	A
					Water chemistry control	VIII.B1.1-a	3.4.1-7	C
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.1-c	3.4.1-2	A
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.G.1-b	3.4.1-1	B
				Loss of material	Water chemistry control	VIII.G.1-c	3.4.1-2	402, A
		Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Treated water (internal)	Loss of material	Periodic surveillance and preventive maintenance	VIII.G.2-a	3.4.1-2	E
					Water chemistry control	VIII.G.2-a	3.4.1-2	A
Servo housing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
Sight glass	Pressure boundary	Glass	Air (external)	None	None			J
			Lube oil (internal)	None	None			J
Sight glass (housing)	Pressure boundary	Copper alloy	Air (external)	None	None			J
			Lube oil (internal)	Loss of material	Oil analysis			J

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steam trap	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Periodic surveillance and preventive maintenance	VIII.B1.1-c	3.4.1-6	E
					Water chemistry control	VIII.B1.1-a	3.4.1-7	C
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.1-c	3.4.1-2	C
Tank	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
		Stainless steel	Outdoor air (external)	None	None			G
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	A

Table 3.4.2-3 Emergency Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure boundary	Stainless steel	Air (external)	None	None			J
			Lube oil (internal)	Cracking	Oil analysis			401
				Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Treated water (internal)	Cracking	Water chemistry control			401
				Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C
Tubing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.1-c	3.4.1-2	A
		Stainless steel	Air (external)	None	None			F
			Treated water (internal)	Cracking	Water chemistry control			F
				Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C

Table 3.4.2-3 Emergency Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Turbine casing	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Steam > 220 (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	D
				Loss of material	Periodic surveillance and preventive maintenance	VIII.B1.1-c	3.4.1-6	E
					Water chemistry control	VIII.B1.1-a	3.4.1-7	C
Valve	Pressure boundary	Carbon steel	Air (external)	Loss of material	System walkdown	VIII.H.1-b	3.4.1-5	A
			Lube oil (internal)	Loss of material	Oil analysis	VIII.G.5-d	3.4.1-4	C
			Steam > 220 (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.B1.1-b	3.4.1-1	C
				Loss of material	Flow-accelerated corrosion	VIII.B1.2-b	3.4.1-6	A
					Water chemistry control	VIII.B1.2-a	3.4.1-7	A
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.3-a	3.4.1-2	A
			Treated water > 220°F (internal)	Cracking-fatigue	TLAA-metal fatigue	VIII.G.1-b	3.4.1-1	D
				Loss of material	Water chemistry control	VIII.G.1-c	3.4.1-2	402, C

Table 3.4.2-3 Emergency Feedwater System (Continued)								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Valve (continued)	Pressure boundary	Stainless steel	Air (external)	None	None			F
			Outdoor air (external)	None	None			F
			Treated water (internal)	Loss of material	Water chemistry control	VIII.G.4-b	3.4.1-2	C

3.5 STRUCTURES AND COMPONENT SUPPORTS

3.5.1 Introduction

This section provides the results of the aging management review for structural components and commodities that are subject to aging management review. The following structures and commodity groups are addressed in this section (descriptions are available in the referenced sections).

- containment and containment internals (Section 2.4.1)
- auxiliary building, turbine building and yard structures (Section 2.4.2)
- intake structure and emergency cooling pond (Section 2.4.3)
- bulk commodities (Section 2.4.4)

Table 3.5.1, Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for structures and component supports. Hyperlinks to the program evaluations in Appendix B are provided.

3.5.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for structures and component supports.

- Table 3.5.2-1 Containment and Containment Internals – Summary of Aging Management Evaluation
- Table 3.5.2-2 Auxiliary Building, Turbine Building and Yard Structures – Summary of Aging Management Evaluation
- Table 3.5.2-3 Intake Structure and Emergency Cooling Pond – Summary of Aging Management Evaluation
- Table 3.5.2-4 Bulk Commodities – Summary of Aging Management Evaluation

3.5.2.1 Materials, Environment, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for structures and component supports. Programs are described in Appendix B. Further details are provided in the structure and commodities tables.

3.5.2.1.1 Containment and Containment Internals

Materials

Containment components are constructed of the following materials.

- carbon steel
- reinforced concrete

Environment

Containment components are subject to the following environments.

- exposed to weather
- protected from weather

Aging Effects Requiring Management

The following aging effects associated with the containment require management.

- cracking
- loss of material

Aging Management Programs

The following programs are credited for managing the effects of aging on containment components.

- boric acid corrosion prevention
- containment leak rate
- inservice inspection - containment inservice inspection (IWE and IWL)
- inservice inspection (IWF)
- structures monitoring

3.5.2.1.2 Auxiliary Building, Turbine Building and Yard Structures

Materials

Auxiliary building, turbine building and yard structure components are constructed of the following materials.

- aluminum
- masonry block
- carbon steel
- reinforced concrete

- stainless steel

Environment

Auxiliary building, turbine building and yard structure components are subject to the following environments.

- exposed to borated water
- exposed to weather
- protected from weather

Aging Effects Requiring Management

The following aging effects associated with the auxiliary building, turbine building and yard structures require management.

- cracking
- loss of material

Aging Management Programs

The following aging management programs are credited for managing the aging effects for the auxiliary building, turbine building and yard structure components.

- structures monitoring - masonry wall
- structures monitoring
- water chemistry control

3.5.2.1.3 Intake Structure and Emergency Cooling Pond

Materials

Intake structure and emergency cooling pond components are constructed of the following materials.

- carbon steel
- natural soils
- reinforced concrete

Environment

Intake structure and emergency cooling pond components are subject to the following environments.

- exposed to raw water
- exposed to weather

- protected from weather

Aging Effects Requiring Management

The following aging effects associated with the intake structure and emergency cooling pond requires management.

- loss of form
- loss of material

Aging Management Programs

The following aging management programs are credited for managing the effects of aging on intake structure and emergency cooling pond components.

- service water integrity
- structures monitoring
- periodic surveillance and preventive maintenance

3.5.2.1.4 Bulk Commodities

Materials

Bulk commodities are constructed of the following materials.

- carbon steel
- silicone elastomer
- galvanized steel
- pyrocrete
- PVC
- reinforced concrete
- rubber
- cerafiber (cerablanket)

Environment

Bulk commodities are subject to the following environments.

- exposed to weather
- protected from weather

Aging Effects Requiring Management

The following aging effects associated with bulk commodities require management.

- change in material properties
- cracking
- loss of material

Aging Management Programs

The following aging management programs are credited for managing the effects of aging on bulk commodities.

- fire protection
- inservice inspection (IWF)
- structures monitoring
- containment leak rate

3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant specific programs or that involve TLAAs. Section 3.5.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered in accordance with the corresponding discussions in NUREG-1800, explain the ANO-2 approach to these areas requiring further evaluation. Programs are described in Appendix B.

3.5.2.2.1 PWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

ANO-2 concrete structures are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following.

- high cement content
- low water-to-cement ratio
- proper curing
- adequate air entrainment

ANO-2 concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same American

Society for Testing and Material (ASTM) standards for selection, application and testing of concrete.

The below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Concrete was provided with air content between 3% and 6%. Accessible concrete has not exhibited degradation related to freeze-thaw. Therefore, loss of material and cracking due to freeze-thaw, aggressive chemical attack and corrosion of embedded steel are not applicable for concrete in inaccessible areas. The absence of concrete aging effects is confirmed under the structures monitoring program.

3.5.2.2.1.2 Cracking, Distortion, and Increase in Component Stress Level due to Settlement; Reduction of Foundation Strength due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program

ANO-2 does not rely on a dewatering system for control of settlement. Category 1 structures are founded on sound bedrock which prevents significant settlement. Additionally, concrete within five feet of the highest known ground water level is protected by membrane waterproofing. This membrane protects the containment building concrete against exposure to groundwater. ANO-2 was not identified in IN 97-11 as a plant susceptible to erosion of porous concrete subfoundations. Groundwater was not aggressive during plant construction and there is no indication that groundwater chemistry has significantly changed. No changes in groundwater conditions have been observed at ANO-2.

Cracking, distortion and increase in component stress level due to settlement and reduction of foundation strength due to erosion of porous concrete subfoundation are not applicable to ANO-2 concrete structures.

3.5.2.2.1.3. Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

During normal operation, all areas within containment are below 150ºF ambient temperature. Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for ANO-2 containment concrete.

The structures monitoring program and inservice inspection - containment inservice inspection (IWL) program will monitor for indications of change in material properties for containment concrete. The aging effect “change in material properties” is equivalent to the NUREG-1801 aging effect “reduction of strength and modulus of elasticity.“

3.5.2.2.1.4 Loss of Material due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate

ANO-2 containment concrete in contact with the liner plate is designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete. The concrete meets requirements of later ACI guide ACI 201.2R-77 since both documents use the same ASTM standards for selection, application and testing of concrete. Concrete is monitored for cracks under the structures monitoring program. The steel liner plate and moisture barrier where the liner becomes embedded are inspected in accordance with the inservice inspection (IWE) program. Spills (e.g., borated water spill) are cleaned up in timely manner. Since the conditions in NUREG-1801 are met, for inaccessible areas (i.e., liner plate), loss of material due to corrosion is insignificant.

3.5.2.2.1.5 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The tendon wire and anchorage are not exposed to temperatures sufficiently elevated to cause change in material properties.

The loss of prestress analysis for the containment post-tensioning system is a TLAA, which is evaluated in accordance with 10CFR54.21(c) as documented in Section 4.5.

3.5.2.2.1.6 Cumulative Fatigue Damage

TLAA are evaluated in accordance with 10CFR54.21(c) as documented in Section 4 of the application. Fatigue analysis TLAAs for the containment liner plate and penetrations are evaluated and documented in Section 4.6 and loss of prestress for the post-tensioning system in Section 4.5.

3.5.2.2.1.7 Cracking due to Cyclic Loading and SCC

Aging mechanisms that can lead to cracking of penetration sleeves and penetration bellows are cyclic loads and stress corrosion (SCC). Further evaluation is recommended of inspection methods to detect cracking due to cyclic loading and SCC since visual VT-3 examinations may be unable to detect this aging effect.

Cracking due to cyclic loading of the liner plate and penetrations is a TLAA which is evaluated as documented in Section 4.6. If the number of design cycles is not exceeded, cracking due to cyclic loading is not an aging effect requiring management.

Stress corrosion cracking becomes significant for stainless steel if tensile stresses and a corrosive environment exist. The stresses may be applied (external) or residual (internal). The environment inside containment is dry under normal operating conditions. The penetration components are not exposed to corrosive environments. Therefore, stress corrosion cracking is not an aging effect requiring management for the penetration sleeves and bellows, since the conditions necessary for SCC do not exist.

3.5.2.2.2 Class I Structures

3.5.2.2.2.1 Aging of Structures not Covered by Structures Monitoring Program

ANO-2 concrete structures subject to aging management review are included in the structures monitoring program. This is true for concrete items even if the aging management review did not identify aging effects requiring management. Aging effects discussed below for structural steel items are also addressed by the structures monitoring program. Additional discussion of specific aging effects follows.

(1) Freeze-thaw

ANO-2 structures are designed in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which results in low permeability and resistance to aggressive chemical solutions by requiring the following.

- high cement content
- low water-to cement ratio
- proper curing
- adequate air entrainment

ANO-2 concrete also meets requirements of later ACI guide ACI 201.2R-77 since both documents use the same ASTM standards for selection, application and testing of concrete.

ANO-2 concrete was provided with air content between 3 percent and 6 percent. Inspections have not exhibited degradation related to freeze-thaw. Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for ANO-2 concrete.

(2) Leaching of calcium hydroxide and aggressive chemical attack

ANO-2 concrete is not exposed to flowing water and the concrete used was constructed in accordance with the recommendations in ACI 201.2R-77 for durability.

ANO-2 below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide are not applicable aging effects for ANO-2 concrete structures.

(3) Reaction with aggregates

ANO-2 concrete was provided in accordance with ACI 318 requirements resulting in dense, well-cured, high-strength concrete with low-permeability. Nonreactivity of concrete aggregates was taken into consideration during production, as described in the design specification. Therefore, reaction with aggregates is not an applicable aging mechanism for ANO-2 concrete.

(4) Corrosion of embedded steel

ANO-2 concrete was provided in accordance with ACI 318 requirements resulting in dense, well-cured, high-strength concrete with low permeability. The below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an applicable aging mechanism for ANO-2 concrete.

(5) Settlement.

See Section 3.5.2.2.1.2 above.

(6) Erosion of porous concrete subfoundation.

See Section 3.5.2.2.1.2 above.

(7) Corrosion of structural steel components.

Corrosion of structural steel components is an aging effect required management at ANO-2. This aging effect is monitored by the structures monitoring program.

(8) Elevated temperatures.

Concrete within Class I structures is typically exposed to ambient temperatures of less than 150ºF. Therefore, change in material properties owing to elevated temperature is not an aging effect requiring management for ANO-2.

(9) Aging effects for stainless steel liners for tanks

No tanks with stainless steel liners are included in the structural aging management reviews. Tanks subject to aging management review are evaluated with their respective mechanical systems.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

ANO-2 concrete was provided in accordance with specification ACI 318-63, Building Code Requirements for Reinforced Concrete, which requires the following, resulting in low permeability and resistance to aggressive chemical solution.

- high cement content
- low water permeability
- proper curing
- adequate air entrainment

ANO-2 concrete also meets requirements of later ACI guide ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same ASTM standards for selection, application and testing of concrete.

Inspections of accessible concrete have not revealed degradation related to corrosion of embedded steel. ANO-2 below-grade environment is not aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1,500 ppm). Therefore, corrosion of embedded steel is not an applicable aging mechanism for ANO-2 concrete.

3.5.2.2.3 Component Supports

3.5.2.2.3.1 Aging of Supports not Covered by Structures Monitoring Program

NUREG-1801 does not recommend further evaluation of certain component support/aging effect combinations if they are included in the applicant's structure monitoring program. Components supports at ANO-2 are included in the structures monitoring program for Groups B2-B5 and inservice inspection (IWF) program for Group B1.

(1) Reduction in concrete anchor capacity due to surrounding concrete for Groups B1 through B5 supports

ANO-2 concrete anchors and surrounding concrete are included in the structures monitoring program (Groups B2 through B5) and inservice inspection (IWF) program (Group B1).

(2) Loss of material due to environmental corrosion, for Groups B2-B5 supports

Loss of material due to corrosion of steel support components is an aging effect requiring management at ANO-2. This aging effect is managed by the structures monitoring program.

(3) Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

The ANO-2 aging management review did not identify any component support structure/aging effect combination corresponding to NUREG-1801 Volume 2 Item III.B4.2-a.

3.5.2.2.3.2 Cumulative Fatigue Damage due to Cyclic Loading

TLAA are evaluated in accordance with 10CFR54.21(c) as documented in Section 4 of this application. During the process of identifying TLAAs in the ANO-2 current licensing basis, no fatigue analyses were identified for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3.

3.5.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10CFR Part 50, Appendix B. The ANO-2 corrective action program applies to both safety-related and nonsafety-related structures and components. Administrative controls for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.5.2.3 Time-Limited Aging Analyses

TLAA identified for structural components and commodities are concrete containment tendon prestress and containment liner plate and penetration fatigue analyses. These topics are discussed in Section 4.5 and Section 4.6, respectively.

3.5.3 Conclusion

The structural components and commodities subject to aging management review have been identified in accordance with the criteria of 10CFR54.21. The aging management programs selected to manage the effects of aging on structural components and commodities are identified in the following tables.

A description of the aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the structural components and commodities will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.5.1
Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801

Table 3.5.1: Structures and Component Supports					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
Common Components of All Types of PWR and BWR Containment					
3.5.1-1	Penetration sleeves, penetration bellows, and dissimilar metal welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10CFR54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.5.2.2.1.6)	The penetration fatigue analysis is discussed in Section 4.6. For further evaluation, see Section 3.5.2.2.1.6 of this application.
3.5.1-2	Penetration sleeves, bellows, and dissimilar metal welds	Cracking due to cyclic loading; crack initiation and growth due to SCC	Containment inservice inspection (ISI) and containment leak rate test	Yes, detection of aging effects is to be evaluated (see NUREG-1800 Subsection 3.5.2.2.1.7)	For further evaluation, see Section 3.5.2.2.1.7 of this application.
3.5.1-3	Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material due to corrosion	Containment ISI and containment leak rate test	No	Containment inservice inspection and containment leak rate program will manage this aging effect. Containment inservice inspection is a plant-specific program for ANO-2.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-4	Personnel airlock and equipment hatch	Loss of material due to corrosion	Containment ISI and containment leak rate test	No	Containment inservice inspection and containment leak rate program will manage this aging effect. Containment inservice inspection is a plant-specific program for ANO-2.
3.5.1-5	Personnel airlock and equipment hatch	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	Containment leak rate test and plant technical specifications	No	Consistent with NUREG-1801. NUREG-1801 lists Technical Specifications (TS) as an aging management program, although a specific section is not provided. ANO-2 TS are not described as an aging management program but TS applicability will continue in the period of extended operation.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-6	Seals, gaskets, and moisture barriers	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and containment leak rate test	No	For ANO-2, the containment leak rate test is credited for managing the aging effects. Seals and gaskets are not included in the containment inservice inspection (IWE) program at ANO-2. The aging effect cited in the NUREG-1801 item is loss of sealing. Loss of sealing is a consequence of the aging effects cracking and change in material properties. The terminology is considered technically equivalent.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment					
3.5.1-7	Concrete elements: foundation, dome, and wall	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Yes, if aging mechanism is significant for inaccessible areas (see NUREG-1800 Subsection 3.5.2.2.1.1)	Aging mechanisms are not significant for accessible and inaccessible areas. Components are included in the containment inservice inspection program and the structures monitoring program. See Section 3.5.2.2.1.1 of this application.
3.5.1-8	Concrete elements: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.1.2)	Settlement is not a significant aging mechanism for ANO-2. See Section 3.5.2.2.1.2 of this application. Nonetheless, components are included in the structures monitoring program.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-9	Concrete elements: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.1.2)	Not applicable. ANO-2 was not identified in IN 97-11 as one of the plants susceptible to erosion of porous concrete subfoundation. See Section 3.5.2.2.1.2 of this application. Nonetheless, concrete foundation is included in the structures monitoring and containment inservice inspection programs.
3.5.1-10	Concrete elements: foundation, dome, and wall	Reduction of strength and modulus due to elevated temperature	Plant specific	Yes, for any portions of concrete containment that exceed specified temperature limits (see NUREG-1800 Subsection 3.5.2.2.1.3)	See Section 3.5.2.2.1.3 of this application. ANO-2 concrete elements do not exceed specified temperature limits. Nonetheless, concrete elements are included in the structures monitoring and containment inservice inspection programs.
3.5.1-11	Prestressed containment: tendons and anchorage components	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10CFR54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.5.2.2.1.5)	For further evaluation, see Section 3.5.2.2.1.5 of this application.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-12	Steel elements: liner plate and containment shell	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and containment leak rate test	Yes, if corrosion is significant for inaccessible areas (see NUREG-1800 Subsection 3.5.2.2.1.4)	Consistent with NUREG-1801. Corrosion is not significant for inaccessible areas. See Section 3.5.2.2.1.4 of this application.
3.5.1-13	BWR only				
3.5.1-14	Steel elements: protected by coating	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	No	Not applicable. Protective coatings are not relied upon to manage the effects of aging at ANO-2.
3.5.1-15	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	No	Loss of material due to corrosion is not significant aging effect for ANO-2 prestressed tendons and anchorage components. See Section 3.5.2.2.1.4 of this application. These components are included in the containment inservice inspection (IWE) program.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-16	Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	No	The listed aging effects and mechanisms are not applicable for the listed ANO-2 concrete components. Nonetheless, the components are included in the structures monitoring and containment inservice inspection programs. See Section 3.5.2.2.2.1 of this application.
3.5.1-17	BWR only				
3.5.1-18	BWR only				
3.5.1-19	BWR only				
Class I Structures					
3.5.1-20	All Groups except Group 6: accessible interior/exterior concrete and steel components	All types of aging effects	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.2.1)	Consistent with NUREG-1801. Components in the following tables that reference Table 1 Item 3.5.1-20 are included in the structures monitoring program.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-21	Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant specific	Yes, if an aggressive below-grade environment exists (see NUREG-1800 Subsection 3.5.2.2.2.2)	Not applicable to ANO-2. An aggressive below-grade environment does not exist. See discussion in Section 3.5.2.2.2.2 of this application.
3.5.1-22	Group 6: all accessible/ inaccessible concrete, steel, and earthen components	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance	No	The listed aging management program is not used. The structures monitoring program will manage the effects of aging on Group 6 components.
3.5.1-23	Group 5: liners	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Water chemistry and monitoring of spent fuel pool water level	No	This line item is not referenced. The NUREG-1801 environment is “exposed to water” rather than exposed to borated water. The water chemistry control program is credited with managing aging effects for the spent fuel pool liner.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-24	Groups 1-3, 5, 6: all masonry block walls	Cracking due to restraint, shrinkage, creep, and aggressive environment	Masonry wall	No	Consistent with NUREG-1801. At ANO-2 the structures monitoring - masonry wall is part of the structures monitoring program.
3.5.1-25	Groups 1-3, 5, 7-9: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.1.2)	Settlement is not a significant aging mechanism for ANO-2. See Section 3.5.2.2.1.2 of this application for further discussion. Nonetheless, components are included in the structures monitoring program.
3.5.1-26	Groups 1-3, 5-9: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.1.2)	ANO-2 was not identified in IN 97-11 as one of the plants susceptible to erosion of porous concrete subfoundation. Nonetheless, concrete foundation is included in structures monitoring program. See Section 3.5.2.2.1.2 of this application for further discussion.

Table 3.5.1: Structures and Component Supports (Continued)					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.5.1-27	Groups 1-5: concrete	Reduction of strength and modulus due to elevated temperature	Plant specific	Yes, for any portions of concrete that exceed specified temperature limits (see NUREG-1800 Subsection 3.5.2.2.1.3)	Not applicable for ANO-2 concrete components. See Section 3.5.2.2.1.3 of this application. Nonetheless, component is included in the structures monitoring program.
3.5.1-28	Groups 7, 8: liners	Crack initiation and growth due to SCC; loss of material due to crevice corrosion	Plant specific	Yes [no subsection given]	Not applicable as there are no concrete or steel tanks with stainless steel liners included in the structural aging management reviews. Tanks are evaluated with their respective mechanical systems.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
Component Support					
3.5.1-29	All Groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc.	Aging of component supports	Structures monitoring	No, if within the scope of the applicant's structures monitoring program (see NUREG-1800 Subsection 3.5.2.2.3.1)	Consistent with NUREG-1801. Listed components that refer to this item in Tables 3.5.2.1 through 3.5.2.4 are included in the structures monitoring program. See Section 3.5.2.2.3.1 of this application.
3.5.1-30	Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds	Cumulative fatigue damage (CLB fatigue analyses exists)	TLAA evaluated in accordance with 10CFR54.21(c)	Yes, TLAA (see NUREG-1800 Subsection 3.5.2.2.3.2)	For further evaluation, see Section 3.5.2.2.3.2 of this application.
3.5.1-31	All Groups: support members: anchor bolts and welds	Loss of material due to boric acid corrosion	Boric acid corrosion	No	Consistent with NUREG-1801 for components in containment. Component groups in the auxiliary building may reference this item, since they are susceptible to the same aging effect and mechanism.

Table 3.5.1: Structures and Component Supports (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-32	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	No	The inservice inspection (IWF) program will manage the identified aging effect. The inservice inspection program is a plant-specific program for ANO-2.
3.5.1-33	Group B1.1: high strength low-alloy bolts	Crack initiation and growth due to SCC	Bolting integrity	No	At ANO-2, the programs that will manage cracking due to SCC are inservice inspection (IWF) and boric acid corrosion prevention programs instead of bolting integrity program. This line item is not referenced in the 3.5.2-series tables.

<u>Notes for Table 3.5.2-1 through 3.5.2-4</u>

<u>Generic notes</u>

A. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect and aging management program listed for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and aging management program for NUREG-1801 line item. AMP takes some exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 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.

<u>Plant-specific notes</u>

501. The ANO environment is not conducive to the listed aging effects. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation.

502. Fatigue is not an applicable aging effect unless design cycle limit is exceeded. This will be confirmed by evaluation documented in TLAA report.

Table 3.5.2-1
Containment and Containment Internals
Summary of Aging Management Evaluation

Table 3.5.2-1: Containment and Containment Internals

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Anchorage and embedments and attachments	SNS, SSR, SRE	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A1.2-a	3.5.1-12	E
Liner plate	FLB, PB, SP				Containment leak rate			A
CEDM support structure	SP, SSR	Stainless steel	Protected from weather	None	None			F
Electrical penetrations	SSR, PB	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A3.1-a	3.5.1-3	E
					Containment leak rate			A
Equipment hatch	SSR, SP, FLB, MB, PB	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A3.2-a	3.5.1-4	E
					Containment leak rate			A

Table 3.5.2-1: Containment and Containment Internals (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fuel handling bridge, crane rails and supports	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	VII B.1-b	3.3.1-16	E
Mechanical penetrations	SSR, PB	Carbon steel	Protected from weather	Cracking	TLAA-containment liner plate and penetration fatigue analyses	II A3.1-b	3.5.1-1	A, 502
Personnel airlock Emergency personnel airlock	MB, FLB, PB	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A3.2-a	3.5.1-4	E
					Containment leak rate			A
Polar crane, crane rails, and support	SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	VII.B.1-b	3.3.1-16	E
Pressurizer support steel	SSR	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a	3.5.1-32	E
Reactor vessel support steel	SSR	Carbon steel	Protected from weather	Loss of material	Boric acid corrosion prevention	III B1.1.1-b	3.5.1-31	C
Refuel maintenance support structure	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A4.2-a	3.5.1-20	A

Table 3.5.2-1: Containment and Containment Internals (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steam generator support steel	SSR, HELB	Carbon steel	Protected from weather	Loss of material	Boric acid corrosion prevention	III B1.1.1-b	3.5.1-31	C
Structural steel	SNS, SP, SSR, MB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A4.2-a	3.5.1-20	A
Sump penetrations	SSR, HS	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A3.1-a	3.5.1-3	E
					Containment leak rate			A
Tendon anchorage Tendon wires	SSR	Carbon steel	Protected from weather	Loss of material	Containment inservice inspection	II A1.3-a	3.5.1-3	E
				Cracking	TLAA-concrete containment tendon prestress	II A1.3-b	3.5.1-11	H, 502
Threaded fasteners, reactor vessel support connections	SSR	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III B1.1.1-a	3.5.1-32	E
					Boric acid corrosion prevention	III B1.1.1-b	3.5.1-31	A

Table 3.5.2-1: Containment and Containment Internals (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Threaded fasteners, various steel connections	SSR	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III B5.1-a	3.5.1-29	A
Basement floor slab (includes sump and instrumentation tunnel)	SSR, SNS, FLB, FB, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Columns, other walls, hatches	SSR, SP, SNS, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Dome Cylinder wall, buttress, ring girder	SSR, SP, SNS, MB, FLB, FB, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
					Containment inservice inspection			
Floor	SSR, SNS, FLB, FB, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Foundation and subfoundation	SSR, SNS, FLB, FB, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Pressurizer support foundation	SSR	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501

Table 3.5.2-1: Containment and Containment Internals (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Primary and secondary shield walls	SSR, SP, SNS, MB, HELB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Reactor missile shield	SSR, SP, MB, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Refuel canal	SP	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Steam generator and reactor vessel foundation	SSR	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501

Table 3.5.2-2
Auxiliary Building, Turbine Building and Yard Structures
Summary of Aging Management Evaluation

Table 3.5.2-2: Auxiliary Building, Turbine Building and Yard Structures								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
AAC generator building (framing and structural shapes)	SRE	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C
Aux building battery racks associated with battery banks 2D11, 2D12, 2D13	SSR	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	E
Control room extension substructure	MB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C
EDG stack vent exterior louvers	SSR	Carbon steel	Exposed to weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C
Exhaust stack supports (i.e., EDGs and EFW turbine)	SSR	Carbon steel	Protected weather	Loss of material	Structures monitoring	III B3.1-a	3.5.1-29	C
Fuel handling bridge assembly (2H3) crane rails and girders	SSR	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C
HELB doors	HELB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C

Table 3.5.2-2: Auxiliary Building, Turbine Building and Yard Structures (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
New fuel racks	SSR	Aluminum	Protected from weather	None	None			F
Spent fuel handling overhead cranes (L-3 and 2L-35)	SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	VII B.1-b	3.3.1-16	E
Spent fuel pool bulkhead gates	SSR, SNS, SP	Stainless steel	Exposed to borated water	Loss of material	Water chemistry control			J
Spent fuel pool liner	SSR, SNS, SP	Stainless steel	Exposed to borated water	Loss of material	Water chemistry control			G
Spent fuel pool superstructure framing	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A5.2-a	3.5.1-20	C
Switchyard bus structural support Transformer bus structural supports	SRE	Carbon steel	Exposed to weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	A
Tank, 2T12, vault beams, top of steel el. 353'-3 5/8"	SSR	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C
Watertight and flood doors	FLB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A3.2-a	3.5.1-20	C

Table 3.5.2-2: Auxiliary Building, Turbine Building and Yard Structures (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
AAC generator foundation	SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Aux bldg columns and beams (all floors)	SSR, SNS, SRE, MB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Aux building exterior walls, above grade	SSR, SNS, SRE, FLB, FB, MB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Aux building exterior walls, below grade	SSR, SNS, SRE, FLB, FB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Aux building floor slabs Aux building interior walls	SSR, SNS, SRE, MB, FLB, FB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Aux building foundation mat	SSR, SNS, SRE, FLB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Auxiliary building sump	SSR	Reinforced Concrete	Protected from weather	None	Structures monitoring			I, 501
Category 1 electrical manholes (walls, slab and ducts)	SSR, SNS, FB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Category 1 electrical manhole covers	SSR, SNS, MB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501

Table 3.5.2-2: Auxiliary Building, Turbine Building and Yard Structures (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Category 1 masonry block walls	MB, FLB, FB, SSR, SNS, SRE	Masonry block	Protected from weather	Cracking	Structures monitoring - masonry wall	III A3.3-a A6.3-a	3.5.1-24	A
Emergency diesel fuel storage tank vault walls and floor slab	MB, FLB, FB, SSR, SNS, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Emergency diesel fuel vault walls above and below grade	FLB, FB,MB SSR, SNS, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Fuel oil storage tank T-25 foundation	SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
PASS building substructure	FLB, FB, SNS,	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Roof slabs	SP	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
RWT 2T3 foundation	SSR	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Sodium hydroxide tank 2T10 foundation	SNS	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Spent fuel pool bottom slab and walls	SSR, SNS, MB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Startup #3 transformer foundation	SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501

Table 3.5.2-2: Auxiliary Building, Turbine Building and Yard Structures (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Startup #3 transformer concrete firewalls and missile shields	FB, MB, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Switchyard circuit breaker 1262F03 structural foundation	SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Tank 2T12 vault walls and slab	FLB, SP, SSR	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Tank T41B foundation, valve pit and pipe trench	MB, SSR, SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Transformer bus foundations	SRE	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501

Table 3.5.2-3
Intake Structure and Emergency Cooling Pond
Summary of Aging Management Evaluation

Table 3.5.2-3: Intake Structure and Emergency Cooling Pond								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Beams in service water and circulating water bays, ~ El. 351’	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A6.2-a	3.5.1-22	E
Floor hatches	FLB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A6.2-a	3.5.1-22	E
Louvered doors (includes ANO-1)	SSR, SRE	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A6.2-a	3.5.1-22	E
Support for roof hatches (includes ANO-1)	SSR, SNS, MB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III A6.2-a	3.5.1-22	E
Submerged pump and shaft supports (includes ANO-1)	SSR, SNS	Carbon steel	Exposed to raw water	Loss of material	Structures monitoring Service water integrity	III A6.2-a	3.5.1-22	E
Building foundation	SSR, SNS, FLB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Columns and beams (all floors)	SSR, SNS	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501

Table 3.5.2-3: Intake Structure and Emergency Cooling Pond (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
ECP concrete intake	SSR, SRE	Reinforced concrete	Exposed to raw water	Loss of material	Structures monitoring Service water integrity			I, 501
Exterior walls, above grade	SSR, SP, SNS, MB	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Exterior walls, below grade	SSR, SNS, FLB	Reinforced concrete	Exposed to weather	Loss of material	Structures monitoring	III A6.1-h	3.5.1-22	E
Floor slabs Interior walls	SSR, SNS, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Roof slabs	SSR	Reinforced concrete	Exposed to weather	None	Structures monitoring			I, 501
Emergency cooling pond	SSR, SRE, HS	Natural soils	Exposed to weather	Loss of form	Periodic surveillance and preventive maintenance - ECP sounding	III A6.4-a	3.5.1-22	E
Intake canal	SRE	Natural soils	Exposed to weather	None	None			I

Table 3.5.2-4
Bulk Commodities
Summary of Aging Management Evaluation

Table 3.5.2-4: Bulk Commodities

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Base plates	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a III.B1.3.1-a	3.5.1-32	E
			Exposed to weather	Loss of material	Inservice inspection	III.B1.3.1-a	3.5.1-32	E
					Structures monitoring	III.B2.1-a	3.5.1-29	A
Cable tray and conduit supports, embedded unistrut	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.B2.1-a	3.5.1-29	A
		Galvanized steel	Protected from weather	Loss of material	Structures monitoring			F
Component supports (instrument racks, frames, etc.)	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	E
					Structures monitoring	III B2.1-a III B3.1-a III B4.1-a III B5.1-a	3.5.1-29	A
Electrical instrument panels and enclosures	SSR, SP, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III B3.1-a	3.5.1-29	C

Table 3.5.2-4: Bulk Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Fire damper framing (in-wall)	FB	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III B2.1-a	3.5.1-29	C
Fire doors	FB	Carbon steel	Protected from weather	Loss of material	Fire protection	VII.G.1-d VII.G.2-d VII.G.3-d VII.G.4-d VII.G.5-c	3.3.1-20	B
Fire hose reels	SRE	Carbon steel	Protected from weather	Loss of material	Fire protection			J
HVAC missile barrier	MB, SP	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.A2.2-a	3.5.1-20	C
Main steam line support structure	SSR	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a III.B1.1.3-a	3.5.1-32	E
Monorails, crane rails and girders	SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	VII.B.1-b	3.3.1-16	E
Pipe sleeves (mechanical/electrical, not penetrating the containment liner plate)	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.B2.1-a	3.5.1-29	C

Table 3.5.2-4: Bulk Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Piping supports	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a III.B1.2.1-a III.B1.2.2-a	3.5.1-32	E
					Structures monitoring	III.B2.1-a	3.5.1-29	A
Piping whip restraints	SSR, SP	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.B2.1-a	3.5.1-29	C
Stairs, ladders, platforms, and grating (supports)	SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.B5.1-a	3.5.1-29	C
Anchor bolts	SSR, SNS, SRE	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B1.1.1-a III.B1.2.1-a	3.5.1-32	E
					Structures monitoring	III.B2.1-a	3.5.1-29	A
			Exposed to weather	Loss of material	Inservice inspection	III.B1.2.1-a	3.5.1-32	E
Anchor bolts (includes switchyard structures and tank anchors)	SSR, SNS, SRE	Carbon steel	Exposed to weather	Loss of material	Structures monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A

Table 3.5.2-4: Bulk Commodities (Continued)

Structure and/or Component/ Commodity	Intended Function	Material	Environment	Aging Effect	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
RCS component support threaded fasteners (for steam generator, reactor coolant pump, pressurizer)	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Inservice inspection	III.B.1.1.1-a	3.5.1-32	E
Reactor cavity missile block tie downs	SSR, SNS	Carbon steel	Protected from weather	Loss of material	Structures monitoring	III.B5.1-a	3.5.1-29	C
Threaded fasteners	SSR, SNS, SRE	Carbon steel	Protected from weather Exposed to weather	Loss of material	Structures monitoring	III.B2.1-a III.B3.1-a III.B4.1-a III.B5.1-a	3.5.1-29	A
Equipment pads	SSR, SNS, SRE	Reinforced concrete	Protected from weather Exposed to weather	None	Structures monitoring			I, 501
Fireproofing	SNS, SRE	Pyrocrete	Protected from weather	None	Structures monitoring Fire protection			I, 501
Flood curbs	FLB, SNS, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501

Table 3.5.2-4: Bulk Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Hatch covers and plugs	SSR, SP, MB, FLB, FB, HELB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Missile shields	MB	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Support pedestals	SSR, SNS, SRE	Reinforced concrete	Protected from weather	None	Structures monitoring			I, 501
Equipment hatch seal	SSR, PB	Rubber	Protected from weather	Cracking Change in material properties	Containment leak rate	II A3.3-a	3.5.1-6	E
Fire barrier seals	SSR, SP, SNS, FLB, FB, HELB	Elastomers	Protected from weather	Cracking Change in material properties	Fire protection	VII.G.1-a VII.G.2-a VII.G.3-a VII.G.4-a	3.3.1-20	B
Fire wrap	SNS, SRE	Cerafiber, cera blanket	Protected from weather	None	None			J

Table 3.5.2-4: Bulk Commodities (Continued)								
Structure and/or Component/ Commodity	**Intended Function**	**Material**	**Environment**	**Aging Effect**	**Aging Management Program**	**NUREG-1801 Vol. 2 Item**	**Table 1 Item**	**Notes**
Joint elastomers at seismic gaps	SSR, SNS, FB	Elastomer	Protected from weather	Cracking Change in material properties	Structures monitoring			J
Penetration seals	FB, FLB, HELB, PB, SSR, SNR, SP	Silicone elastomer	Protected from weather	Cracking Change in material properties	Structures monitoring			J
Water stops	FB	PVC	Protected from weather	None	None			J

3.6 ELECTRICAL AND INSTRUMENTATION AND CONTROLS

3.6.1 Introduction

This section provides the results of the aging management review for electrical components which are subject to aging management review. Consistent with the methods described in NEI 95-10, the electrical and I&C aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups requiring aging management review are addressed in this section.

- insulated cables and connections
- phase bus
- switchyard bus
- high voltage insulators.

Table 3.6.1, Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the electrical and I&C components. This table uses the format described in the introduction to Section 3. Hyperlinks to the program evaluations in Appendix B are provided.

3.6.2 Results

Table 3.6.2-1, Electrical and I&C Components - Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for electrical and I&C components.

3.6.2.1 Materials, Environment, Aging Effects Requiring Management, and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for electrical and I&C components subject to aging management review. Programs are described in Appendix B. Further details are provided in the system tables.

Materials

Electrical and I&C components subject to aging management review are constructed of the following materials.

- aluminum
- cement
- copper and copper alloys
- porcelain
- steel

- organic polymers
- galvanized metals

Environment

Electrical and I&C components subject to aging management review are exposed to the following environments.

- borated water leakage
- heat and air
- moisture and voltage stress
- radiation and air
- outdoor weather

Aging Effects Requiring Management

The following aging effects associated with electrical and I&C components require management.

- loss of circuit continuity
- reduced insulation resistance

Loss of circuit continuity is the aging effect resulting from the mechanism of corrosion of connector contact surfaces that is listed as an aging effect in NUREG-1801.

Aging Management Programs

The following programs will manage the effects of aging on electrical and I&C components:

- boric acid corrosion prevention
- non-eq inaccessible medium-voltage cable
- non-eq insulated cables and connections

3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1801

NUREG-1801 indicates that further evaluation is necessary for certain aging effects, particularly those that require plant-specific programs or that involve TLAAs. Section 3.6.2.2 of NUREG-1800 discusses these aging effects that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain the ANO-2 approach to these areas requiring further evaluation. Programs are described in Appendix B of this application.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification is a TLAA as defined in 10CFR54.3. TLAAs are evaluated in accordance with 10CFR54.21(c). The evaluation of this TLAA is addressed in Section 4.4 of this application.

3.6.2.2.2 Quality Assurance for Aging Management of Nonsafety-Related Components

Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10CFR Part 50, Appendix B. The ANO-2 corrective action program applies to both safety-related and nonsafety-related structures and components. Administrative control for both safety-related and nonsafety-related structures and components are accomplished per the existing ANO-2 document control program in accordance with plant Technical Specifications. See Appendix B Section B.0.3 for further discussion.

3.6.2.3 Time-Limited Aging Analyses

The only TLAAs identified for the electrical and I&C commodity components are evaluations for environmental qualification (EQ). TLAAs are evaluated in Section 4.4 of this application.

3.6.3 Conclusion

The electrical and I&C components that are subject to aging management review have been identified in accordance with the requirements of 10CFR54.21(a)(1). The aging management programs selected to manage aging effects for the electrical and I&C components are identified in the following tables and Section 3.6.2.1.

A description of 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.

Based on the demonstrations provided in Appendix B, the effects of aging associated with electrical and I&C components will be managed such that there is reasonable assurance the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.6.1
Summary of Aging Management Programs for the Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.6.1-1	Electrical equipment subject to 10CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental qualification of electric components	Yes, TLAA (see NUREG-1800 Subsection 3.6.2.2.1)	EQ equipment is not subject to aging management review because it is not long-lived. EQ analyses are evaluated as TLAAs in Section 4.4.
3.6.1-2	Electrical cables and connections not subject to 10CFR 50.49 EQ requirements	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10CFR50.49 EQ requirements	No	Consistent with NUREG-1801. Management of aging effects will be provided by the non-EQ insulated cables and connections program. This program includes inspection of non-EQ electrical and I&C penetration cables and connections. In Table 3.6.2-1, reduced insulation resistance (IR) is considered equivalent to the aging effect listed for this item.

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-3	Electrical cables used in instrumentation circuits not subject to 10CFR50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables used in instrumentation circuits not subject to 10CFR50.49 EQ requirements	No	This item is not applicable to ANO-2, since ANO-2 electrical cables for high range radiation monitors and neutron flux detectors are subject to 10CFR50.49 environmental qualification (EQ) requirements.
3.6.1-4	Inaccessible medium-voltage (2kV to 15kV) cables (e.g., installed in conduit or direct buried) not subject to 10CFR50.49 EQ requirements	Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees	Aging management program for inaccessible medium-voltage cables not subject to 10CFR50.49 EQ requirements	No	Consistent with NUREG-1801. Range of voltages included in this item extends from 4.16kV to 22kV. Management of aging effects will be provided by the non-EQ insulated cables and connections program. In Table 3.6.2-1, reduced insulation resistance (IR) is considered equivalent to the aging effect listed for this item (breakdown of insulation).

Table 3.6.1: Electrical Components, NUREG-1801 Vol. 1 (Continued)

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-5	Electrical connectors not subject to 10CFR 50.49 EQ requirements that are exposed to borated water leakage	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion	No	Consistent with NUREG-1801. Management of aging effects provided by boric acid corrosion prevention. In Table 3.6.2-1, loss of circuit continuity is the aging effect resulting from corrosion of connector contact surfaces.

Notes for Table 3.6.2-1

Generic notes

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 has 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 has exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 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. The aging management program does not include the metallic fuse clamp portion of fuse holders. ANO-2 does not have metallic clamp fuse holders that are within the scope of license renewal.

Table 3.6.2-1
Electrical Components
Summary of Aging Management Evaluation

Table 3.6.2-1: Electrical Components

Component Type	Component Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Electrical cables and connections not subject to 10CFR50.49 EQ requirements	CE	Insulation material – various organic polymers	Heat or radiation and air	Reduced insulation resistance (IR)	Non-EQ insulated cables and connections	VI.A.1-a.	3.6.1-2	A, 601
Inaccessible medium-voltage (4.16kV to 22kV) cables (e.g., installed in conduit or direct buried) not subject to 10CFR 50.49 EQ requirements	CE	Insulation material – various organic polymers	Moisture and voltage stress	Reduced insulation resistance (IR)	Non-EQ inaccessible medium-voltage cable	VI.A.1-c	3.6.1-4	A
Electrical connectors not subject to 10CFR 50.49 EQ requirements that are exposed to borated water leakage	CE	Connectors – various metals	Borated water leakage	Loss of circuit continuity	Boric acid corrosion prevention	VI.A.2-a.	3.6.1-5	A

Table 3.6.2-1: Electrical Components (Continued)

Component Type	Component Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Phase bus (non-segregated bus for SBO), connections	CE	Aluminum, copper, steel	Heat and air Outdoor weather	None	None			J
Switchyard bus (switchyard bus for SBO), connections	CE	Aluminum, copper	Outdoor weather	None	None			J
High voltage insulators	IN	Porcelain, galvanized metal, cement	Outdoor weather	None	None			J

4.0 TIME-LIMITED AGING ANALYSES

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

Section 10CFR54.21(c) requires a list of time-limited aging analyses (TLAA) be provided as part of the application for a renewed license. Time-limited aging analyses are defined in 10CFR54.3.

§54.21 Contents of application -- technical information.
(c) An evaluation of time-limited aging analyses.

(1) A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall demonstrate that —

  (i) The analyses remain valid for the period of extended operation;

  (ii) The analyses have been projected to the end of the period of extended operation; or

  (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

(2) A list must be provided of plant-specific exemptions granted pursuant to 10CFR50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

§54.3 Definitions
Time-limited aging analyses, for the purposes of this part, are those licensee calculations and analyses that:

(1) Involve systems, structures, and components within the scope of license renewal, as delineated in §54.4(a);

(2) Consider the effects of aging;

(3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;

(4) Were determined to be relevant by the licensee in making a safety determination;

(5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in §54.4(b); and

(6) Are contained or incorporated by reference in the CLB.

4.1.1 Process to Identify ANO-2 TLAA

The following site-specific documents were reviewed to identify TLAA for ANO-2:

- Safety Analysis Report (SAR) (Reference 4.1-1)
- Quality Assurance Program Manual
- Fire Hazards Analysis (FHA)
- NRC Safety Evaluation Reports (SER)
- ANO-2/NRC licensing correspondence
- Operating license issued by the NRC for ANO-2
- Technical Specifications

A key word search was performed to identify TLAA from the site-specific documentation. In addition, the original plant SER and topical reports referenced in the SAR were manually reviewed.

The information developed from the review of plant-specific documents was reviewed to determine which calculations and analyses meet the six criteria of 10CFR54.3. The analyses and calculations that meet the criteria are time-limited aging analyses. Table 4.1-1 provides a list of these analyses.

As required by 10CFR54.21(c)(1), an evaluation of each time-limited aging analysis was performed. The results of the evaluation of time-limited aging analyses are presented in Sections 4.2 through 4.7 of this application and are summarized in Table 4.1-1. Table 4.1-2 compares the ANO-2 TLAA to TLAA identified in NUREG-1800 Tables 4.1-2 and 4.1-3.

4.1.2 Identification of Exemptions

10CFR54.21(c)(2) requires that an application for a renewed license include a list of effective plant-specific exemptions granted pursuant to 10CFR50.12 that are based on time-limited aging analyses as defined in 10CFR54.3. A review of the ANO-2 docket identified no 10CFR50.12 exemptions based on a time-limited aging analysis.

4.1.3 References for Section 4.1

4.1-1 Arkansas Nuclear One - Unit 2 Safety Analysis Report, Amendment 17.

4.1-2 NUREG-1800, *Standard Review Plan for Review of License Renewal Application for Nuclear Power Plants*, July 2001.

Table 4.1-1
List of ANO-2 TLAA

TLAA	Description	Disposition Category	LRA Section
1	**Reactor vessel neutron embrittlement**		4.2
	Charpy upper shelf energy	Analysis projected to the end of the period of extended operation 10CFR54.21(c)(1)(ii).	4.2.1
	Pressurized thermal shock	Analysis projected to the end of the period of extended operation 10CFR54.21(c)(1)(ii).	4.2.2
	Pressure-temperature limits	Analysis projected to the end of the period of extended operation 10CFR54.21(c)(1)(ii).	4.2.3
2	**Metal fatigue**		4.3
	Class 1 fatigue	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.3.1
	Non-class 1 fatigue	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.3.2
	Environmentally-assisted fatigue (GSI 190)	Analyses remain valid or are projected to the end of the period of extended operation or effects managed 10CFR54.21(c)(1)(i),(ii), and (iii).	4.3.3.1
	Thermal stresses in piping connected to reactor coolant systems (IEB 88-08)	Effects of aging on the intended function(s) will be adequately managed for the period of extended operation 10CFR54.21(c)(1)(iii).	4.3.3.2
	Pressurizer surge line thermal stratification (IEB 88-11)	Effects of aging on the intended function(s) will be adequately managed for the period of extended operation 10CFR54.21(c)(1)(iii).	4.3.3.3

Table 4.1-1
List of ANO-2 TLAA (Continued)

TLAA	Description	Disposition Category	LRA Section
3	**Environmental qualification of electrical components**	Effects of aging on the intended function(s) will be adequately managed for the period of extended operation 10CFR54.21(c)(1)(iii).	4.4
4	**Concrete containment tendon prestress**	Analyses are projected to the end of the period of extended operation or effects adequately managed 10CFR54.21(c)(1)(ii) and (iii).	4.5
5	**Containment liner plate and penetration fatigue analyses**	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.6
6	**Other plant-specific TLAA**		4.7
	RCS piping leak-before-break	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.7.1
	RCP code case N-481	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.7.2
	RCP flywheel	Analysis not based on current operating term. Not a TLAA.	4.7.3
	Steam generator tubes—flow-induced vibration	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.7.4
	Alloy 600 nozzle repairs	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.7.5
	High energy line break analyses	Analyses remain valid for the period of extended operation 10CFR54.21(c)(1)(i).	4.7.6

Table 4.1-2
Comparison of ANO-2 TLAA to NUREG-1800 TLAA Tables 4.1-2 and 4.1-3

TLAA	NUREG-1800 TLAA Listing	Applicable to ANO-2	LRA Section
1	Reactor vessel neutron embrittlement	Yes	4.2
2	Concrete containment tendon prestress	Yes	4.5
3	Metal fatigue	Yes	4.3
4	Environmental qualification of electrical equipment	Yes	4.4
5	Metal corrosion allowance	No. Loss of material by corrosion of mechanical components addressed as part of the aging management review process discussed in Section 3 of the LRA.	3
6	Inservice flaw growth analyses that demonstrate structure stability for 40 years	No. Review of ISI records indicated no defects that required analytical evaluation of flaws to the end of the service life of the component.	4.3
7	Inservice local metal containment corrosion analyses	No. Loss of material by corrosion of structural components addressed as part of the aging management review process discussed in Section 3 of the LRA.	3
8	High-energy line-break postulation based on fatigue cumulative usage factor	Yes	4.7.6
9	Intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic SS cladding. Low-temperature overpressure (LTOP) analyses	No. Fabrication records reveal that the ANO-2 reactor vessel is not susceptible to intergranular separation. Yes. LTOP is reviewed as part of the pressure-temperature limits.	NA 4.2.3

Table 4.1-2
Comparison of ANO-2 TLAA to NUREG-1800 TLAA Tables 4.1-2 and 4.1-3 (Continued)

TLAA	NUREG-1800 TLAA Listing	Applicable to ANO-2	LRA Section
10	Fatigue analysis for the main steam supply lines to the turbine driven auxiliary feedwater lines	Yes. Piping is designed to USAS B31.1 and fatigue is addressed through stress range reduction factor.	4.3
11	Fatigue analysis for the reactor coolant pump flywheel	No. Analysis in CLB does not involve time-limited assumptions defined by the current operating term.	4.7.3
12	Fatigue analysis of the polar crane	No. The crane was designed to CMAA-70 and the assessment of fatigue is based on qualitative analysis and not defined by the current operating term.	NA
13	Flow-induced vibration endurance limit, transient cycle count assumptions, and ductility reduction of fracture toughness for the reactor vessel internals	No. Review did not identify these listings as TLAA applicable to ANO-2.	NA
14	Leak before break	Yes	4.7.1
15	Fatigue analysis for the containment liner plate	Yes	4.6
16	Containment penetration pressurization cycles	Yes	4.6
17	Reactor vessel circumferential weld inspection relief (BWR)	No. Applicable to BWRs.	NA

4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The regulations governing reactor vessel integrity are in 10CFR50:

- 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 boundary as set forth in Appendices G and H of 10CFR50.
- Section 50.61 contains fracture toughness requirements for protection against pressurized thermal shock.

The design bases of ANO-2 contain calculations and analyses addressing the effects of neutron irradiation embrittlement of the reactor vessel. The analyses that evaluated the reduction of fracture toughness of the ANO-2 reactor vessel for 40 years are TLAA. The analyses for the initial 40-year license were updated to address the additional twenty years of operation (i.e., 60 years) for license renewal. The ANO-2 reactor vessel integrity program described in Appendix B will ensure that the time-dependent parameters used in the TLAA and described below remain valid through the period of extended operation. The reactor vessel neutron embrittlement TLAA are projected to the end of the period of extended operation in accordance with 10CFR54.21 (c)(1)(ii) as summarized below.

4.2.1 Charpy Upper Shelf Energy

Appendix G of 10CFR50 requires that reactor vessel beltline materials “have Charpy upper-shelf energy … of no less than 75 ft. lb. initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft. lb.….”. The ANO-2 analyses on upper-shelf energy for 32 effective full power years (EFPY) were originally documented in the response to NRC Generic Letter 92-01, Revision 1. Thirty-two EFPY would be reached at the end of the period of initial operation (40 years) using an assumed capacity factor of 80%. Similarly, forty-eight EFPY is assumed at the end of the period of extended operation (60 years) based on a capacity factor of 80%.

Regulatory Guide 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” provides two positions for determining Charpy upper-shelf energy (C_VUSE). Position 1 applies for material that does not have surveillance data available and Position 2 applies for material that does have surveillance data. For Position 1, the percent drop in C_VUSE, for a stated copper content and neutron fluence, is determined by reference to Figure 2 of Regulatory Guide 1.99, Revision 2. This percentage drop is applied to the initial C_VUSE to obtain the adjusted C_VUSE. For Position 2, the percent drop in C_VUSE is determined by plotting the available data on Figure 2 and fitting the data with a line drawn parallel to the existing lines that upper bounds all the plotted points.

The 48 EFPY C_VUSE values for the reactor vessel beltline materials for ANO-2 were calculated using Regulatory Guide 1.99, Revision 2, Positions 1 and 2. The 48 EFPY T/4 fluence values were calculated in accordance with Regulatory Guide 1.99, Revision 2, Equation (3) using best estimate fluence estimates at the inside (wetted) surface of the vessel calculated using the method reported in BAW-2241P-A, Revision 1 (Reference 4.2-1); this method meets the uncertainty requirements of Regulatory Guide 1.190. Three dimensional fluence values were calculated at the inside surface of the vessel assuming a power level of 2815 MWt for cycles 1 through14 (the last ANO-2 capsule was pulled at the end of cycle 14). An average flux value for cycles 10 through14 was calculated and used to extrapolate fluence through the end of cycle 15 assuming a power level of 2815 MWt. Power uprate to 3026 MWt (approximately 7.5%) was assumed at the beginning of cycle 16 and end of life fluence was estimated for 48 EFPY. A peak inside (wetted) surface fluence of 5.277E+19 n/cm^2 at 48 EFPY is estimated for the lower shell plates. As shown in Table 4.2-1, the C_VUSE is maintained above 50 ft-lb for the evaluated base metal and weld at 48 EFPY. Therefore, the calculation of upper shelf energy has been projected to the end of the period of extended operation in accordance with 10CFR54.21(c)(1)(ii).

A comparison of copper content and initial unirradiated C_VUSE values for ANO-2 beltline materials listed in Table 4.2-1 to the values reported in the NRC reactor vessel integrity database (RVID2) indicate slight differences for selected plate materials. The most significant difference is the unirradiated CvUSE for plate 8009-3: RVID2 lists 126 ft-lb versus 87 ft-lb reported in Table 4.2-1. All values of unirradiated CvUSE listed in Table 4.2-1 were obtained by multiplying the minimum unirradiated CvUSE longitudinal-oriented values reported in Table 5.2-5 of the ANO-2 SAR by 65% to obtain conservative values expected from transverse-oriented specimens. The unirradiated CvUSE of 126 ft-lb for plate 8009-3 reported in RVID2 is based on transverse-oriented mechanical properties of plate 8009-3 as reported in Table 5.2-16 of the ANO-2 SAR. Use of 65% of the longitudinal-oriented unirradiated CvUSE value for plate 8009-3 provides a lower unirradiated upper shelf energy and is conservative. In addition, the upper shell to intermediate shell circumferential weld material is listed in the RVID2 but is not included in Table 4.2-1 since it is not a limiting material in accordance with the beltline definition provided in 10CFR50.61. The differences between RVID2 and Table 4.2-1 are not significant and do not alter the conclusion that C_VUSE is maintained above 50 ft-lb for all base metal (plates and forgings) and welds at 48 EFPY.

4.2.2 Pressurized Thermal Shock

Section 10CFR50.61(b)(1) provides rules for protection against pressurized thermal shock for pressurized water reactors. Licensees are required to perform an assessment of the projected values of reference temperature whenever a significant change occurs in projected values of RT_{PTS}, or upon request for a change in the expiration date for the operation of the facility. For ANO-2 license renewal, RT_{PTS} values are calculated for 48 EFPY.

Fluence values at 48 EFPY for ANO-2 at the clad/base metal interface were obtained using the methodology described in Reference 4.2-1 as described in Section 4.2.1 above. This method meets the uncertainty requirements of Regulatory Guide 1.190. A peak inside vessel/clad interface fluence of 5.0896E+19 n/cm^2 at 48 EFPY is estimated for the lower shell plates.

Section 10CFR50.61(b)(2) establishes screening criteria for RT_{PTS}: 270°F for plates, forgings, and axial welds and 300°F for circumferential welds. The values for RT_{PTS} at 48 EFPY for ANO-2 are provided in Table 4.2-2. The projected RT_{PTS} values were calculated using Regulatory Guide 1.99, Revision 2, Positions 1 and 2, and are all within the established screening criteria for 48 EFPY. The limiting beltline material is lower shell plate C-8010-1, with a 48 EFPY RT_{PTS} of 122.6°F, which is well below the limit of 270°F. Therefore, RT_{PTS} for ANO-2 has been evaluated in accordance with 10CFR54.21(c)(1)(ii) and is determined to be acceptable for the period of extended operation.

A comparison of copper content, nickel content, and unirradiated RT_{NDT} values for ANO-2 beltline materials listed in Table 4.2-2 to the values reported in the NRC reactor vessel integrity database (RVID2) indicate slight differences for selected plate and weld materials. Chemistry factors for surveillance materials have been revised to reflect the use of Regulatory Guide 1.99, Revision 2, Position 2.1. These differences are not significant and do not alter the conclusion that RT_{PTS} values are within the established screening criteria for 48 EFPY. The upper shell to intermediate shell circumferential weld material is listed in the RVID2 but is not included in Table 4.2-2 since it is not a limiting material in accordance with the beltline definition provided in 10CFR50.61.

4.2.3 <u>Pressure-Temperature Limits</u>

Appendix G of 10CFR50 requires that heatup and cooldown of the reactor pressure vessel be accomplished within established pressure-temperature (P-T) limits. These limits are established by calculations that utilize materials and fluence data obtained through the unit-specific reactor vessel surveillance capsule program. Normally, the pressure-temperature limits are calculated for several years into the future and remain valid for an established period of time not to exceed the operating license expiration date.

ANO-2 submitted a license amendment request for reactor coolant system pressure-temperature curves for 32 EFPY (References 4.2-2 and 4.2-3). The curves specify limits on RCS pressure and temperature for up to 32 effective full power years with a 7.5% power uprate. These P-T curves are based on a fluence analysis that complies with Regulatory Guide 1.190 and utilizes ASME Code Cases N-640 and N-588. Based on the ANO-2 P-T limit curves, the operating window at 48 EFPY is sufficient to conduct normal heatup and cooldown operations. Low-temperature overprotection (LTOP) limits are based on the licensed P-T limit analyses and will be updated as required.

Calculations of P-T limits for ANO-2 have been projected to the end of the period of extended operation in accordance with 10CFR54.21(c)(1)(ii).

4.2.4 References for Section 4.2

4.2-1 BAW-2241P-A, Revision 1, *Fluence and Uncertainty Methodologies*, April 1999.

4.2-2 Anderson, Craig (EOI), Letter to US NRC (2CAN100101), Proposed Technical Specification Change Request Regarding Revised ANO-2 Pressure/Temperature and Low Temperature Overpressure Protection Limits for 32 Effective Full Power Years, October 30, 2001.

4.2-3 US NRC, Letter to Craig G. Anderson (EOI) (2CNA040205), Arkansas Nuclear One, Unit 2 – Issuance of Amendment Re: Reactor Vessel Pressure Temperature Limits and Exemption from the Requirements of 10 CFR Part 50, Section 50.60(a), April 15, 2002.

Table 4.2-1
Evaluation of Reactor Vessel Extended Life (48 EFPY) Charpy V-Notch Upper-Shelf Energy: Arkansas Nuclear One, Unit 2

Material Description				Copper Composition Wt. %	Initial CvUSE, ft-lbs	48 EFPY Fluence T/4 Location, n/cm^2	Estimated 48 EFPY CvUSE at T/4, ft-lbs	48 EFPY % Drop at T/4
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type					
Regulatory Guide 1.99, Revision 2, Position 1.1								
Intermediate Shell Long.Weld	2-203 A	10120	Linde 0091	0.046	71	3.015E+19	54	24.2
Intermediate Shell Long.Weld	2-203 B	10120	Linde 0091	0.046	71	2.327E+19	55	22.7
Intermediate Shell Long.Weld	2-203 C	10120	Linde 0091	0.046	71	2.327E+19	55	22.7
Lower Shell Long. Weld	3-203 A	10120	Linde 0091	0.046	79	3.020E+19	60	24.2
Lower Shell Long. Weld	3-203 B	10120	Linde 0091	0.046	79	2.331E+19	61	22.7
Lower Shell Long. Weld	3-203 C	10120	Linde 0091	0.046	79	2.331E+19	61	22.7
Int./Lower Shell Girth Weld	9-203	83650	Linde 0091	0.045	95	3.187E+19	72	24.3
Intermediate Shell Plate	C-8009-1	C8161-3	SA-533B Cl. 1	0.098	95	3.188E+19	71	24.7
Intermediate Shell Plate	C-8009-2	C8161-1	SA-533B Cl. 1	0.085	92	3.188E+19	71	23.0
Intermediate Shell Plate	C-8009-3	C8182-2	SA-533B Cl. 1	0.096	87	3.188E+19	66	24.5
Lower Shell Plate	C-8010-1	C8161-2	SA-533B Cl. 1	0.085	90	3.192E+19	69	23.0
Lower Shell Plate	C-8010-2	B2545-1	SA-533B Cl. 1	0.083	94	3.192E+19	72	22.8
Lower Shell Plate	C-8010-3	B2545-2	SA-533B Cl. 1	0.080	98	3.192E+19	76	22.4
Regulatory Guide 1.99, Revision 2, Position 2.1								
Intermediate Shell Long.Weld	2-203 A	10120	Linde 0091	0.046	71	3.015E+19	57	19.7
Intermediate Shell Long.Weld	2-203 B	10120	Linde 0091	0.046	71	2.327E+19	58	18.6
Intermediate Shell Long.Weld	2-203 C	10120	Linde 0091	0.046	71	2.327E+19	58	18.6
Lower Shell Long. Weld	3-203 A	10120	Linde 0091	0.046	79	3.020E+19	63	19.7
Lower Shell Long. Weld	3-203 B	10120	Linde 0091	0.046	79	2.331E+19	64	18.6
Lower Shell Long. Weld	3-203 C	10120	Linde 0091	0.046	79	2.331E+19	64	18.6
Intermediate Shell Plate	C-8009-3	C8182-2	SA-533B Cl. 1	0.096	87	3.188E+19	59	32.0

Table 4.2-2
Evaluation of Reactor Vessel Extended Life (48 EFPY) PTS: Arkansas Nuclear One, Unit 2

Material Description				Chemical Composition		Initial RT_{NDT} F	Chemistry Factor	48 EFPY Fluence Vessel/Clad Interface, n/cm^2	Margin	RT_{PTS} F	Screening Criteria
Reactor Vessel Beltline Region Location	**Matl. Ident.**	**Heat Number**	**Type**	**Cu. Wt. %**	**Ni Wt. %**						
10CFR50.61 (Table Values)											
Intermediate Shell Long.Weld	2-203 A	10120	Linde 0091	0.046	0.082	-56	34.0	4.8340E+19	58.4	49.9	270
Intermediate Shell Long. Weld	2-203 B	10120	Linde 0091	0.046	0.082	-56	34.0	3.7467E+19	56.9	46.5	270
Intermediate Shell Long. Weld	2-203 C	10120	Linde 0091	0.046	0.082	-56	34.0	3.7467E+19	56.9	46.5	270
Lower Shell Long. Weld	3-203 A	10120	Linde 0091	0.046	0.082	-56	34.0	4.8418E+19	58.4	49.9	270
Lower Shell Long. Weld	3-203 B	10120	Linde 0091	0.046	0.082	-56	34.0	3.7527E+19	56.9	46.5	270
Lower Shell Long. Weld	3-203 C	10120	Linde 0091	0.046	0.082	-56	34.0	3.7527E+19	56.9	46.5	270
Int./Lower Shell Girth Weld	9-203	83650	Linde 0091	0.045	0.087	-10	34.1	5.0811E+19	47.9	85.8	300
Intermediate Shell Plate	C-8009-1	C8161-3	SA-533B Cl. 1	0.098	0.605	-26	63.6	5.0813E+19	34.0	97.4	270
Intermediate Shell Plate	C-8009-2	C8161-1	SA-533B Cl. 1	0.085	0.600	0	54.5	5.0813E+19	34.0	110.6	270
Intermediate Shell Plate	C-8009-3	C8182-2	SA-533B Cl. 1	0.096	0.580	0	62.2	5.0813E+19	34.0	121.5	270
Lower Shell Plate	C-8010-1	C8161-2	SA-533B Cl. 1	0.085	0.585	12	54.5	5.0896E+19	34.0	122.6	270
Lower Shell Plate	C-8010-2	B2545-1	SA-533B Cl. 1	0.083	0.668	-28	53.1	5.0896E+19	34.0	80.7	270
Lower Shell Plate	C-8010-3	B2545-2	SA-533B Cl. 1	0.080	0.653	-30	51.0	5.0896E+19	34.0	75.7	270
10CFR50.61 (Use of Surveillance Data)											
Intermediate Shell Long. Weld	2-203 A	10120	Linde 0091	0.046	0.082	-56	14.9	4.8340E+19	39.9	4.7	270
Intermediate Shell Long. Weld	2-203 B	10120	Linde 0091	0.046	0.082	-56	14.9	3.7467E+19	39.4	3.4	270
Intermediate Shell Long. Weld	2-203 C	10120	Linde 0091	0.046	0.082	-56	14.9	3.7467E+19	39.4	3.4	270
Lower Shell Long. Weld	3-203 A	10120	Linde 0091	0.046	0.082	-56	14.9	4.8418E+19	39.9	4.7	270
Lower Shell Long. Weld	3-203 B	10120	Linde 0091	0.046	0.082	-56	14.9	3.7527E+19	39.4	3.4	270
Lower Shell Long. Weld	3-203 C	10120	Linde 0091	0.046	0.082	-56	14.9	3.7527E+19	39.4	3.4	270
Intermediate Shell Plate	C-8009-3	C8182-2	SA-533B Cl. 1	0.096	0.580	0	40.7	5.0813E+19	17.0	74.4	270

4.3 METAL FATIGUE

The analysis of metal fatigue is a TLAA for Class 1 and selected non-Class 1 mechanical components within the scope of license renewal. Class 1 items that received a code fatigue evaluation in accordance with ASME Section III, Subsection NB, include the pressurizer, reactor vessel, control element drive mechanism housing assembly, steam generators, reactor coolant pumps (RCPs), and the RCS piping. ASME Section III requires a fatigue analysis for each Class 1 component considering all transient loads based on the anticipated number of transients. The fatigue analysis requires the calculation of the “cumulative usage factor” based on the fatigue properties of the material and the expected fatigue service of the individual component. The stress range allowables are a function of thermal design cycles.

Non-Class 1 pressure vessels, heat exchangers, storage tanks and pumps at ANO-2 are designed in accordance with ASME VIII or ASME III Subsection NC or ND (Class 2 or 3). Some tanks and pumps are designed to other industry codes and standards such as American Water Works Association (AWWA) standards and Manufacturer’s Standardization Society (MSS) standards. Only ASME Section VIII Division 2 and ASME Section III Subsection NC-3200 include fatigue design requirements.

Fatigue evaluations are TLAA since they are based on design transients defined for the life of the plant (SAR Section 5.2.1.5). Class 1 metal fatigue TLAA are evaluated in Section 4.3.1 Class 1 Fatigue and non-Class 1 metal fatigue TLAA are evaluated in Section 4.3.2 Non-Class 1 Fatigue.

In addition to metal fatigue, fracture mechanics analyses of defects discovered during inservice inspection may be TLAA for those analytical evaluations performed to the end of the service life of the component in accordance with ASME Section XI, IWB-3600. The ANO-2 ISI records were reviewed and there have been no analytical evaluations of flaws to the end of the service life of the component.

4.3.1 <u>Class 1 Fatigue</u>

Fatigue evaluations were performed in the design of the ANO-2 Class 1 (Class 1 in this license renewal application is equivalent to ASME Section XI IWB inspection boundary plus non-Class 1 designed RCS instrumentation and vent lines) components in accordance with the requirements specified in ASME Section III. The fatigue evaluations are contained in calculations and stress reports. Because they are based on a number of cycles assumed for a 40-year plant life, these evaluations are TLAA.

Design cyclic loadings and thermal conditions for the reactor coolant system Class 1 components are defined by the applicable design specifications for each component. The original design specifications provided the initial set of transients that were used in the design of the components and are included as part of each component calculation and stress report. The component calculations and stress reports contain the fatigue evaluations for each component.

The ability to withstand cyclic operation without fatigue failure is expressed in terms of calculations required by ASME Section III, i.e., fatigue cumulative usage factors.

The ANO-2 CUFs for Class 1 components designed in accordance with ASME Section III were compiled and the RCS design transients used to develop the cumulative usage factors for the reactor vessel, control element drive mechanism housing assembly, pressurizer, steam generators, RCPs, and RCS piping. The numbers of RCS design transients accrued through 2002 for ANO-2 were reviewed and these numbers were linearly extrapolated to 60 years of operation and are reported in Table 4.3-1. In all instances the number of RCS design transients assumed in the original design were found to be acceptable for 60 years of operation. Therefore, the cumulative usage factors for the Class 1 components remain valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i). The RCS design transients are monitored through the fatigue monitoring program, which is discussed in Appendix B.

ANO-2 performed fatigue evaluations for selected RCS branch piping, some of which were performed in response to NRC Bulletins 88-08 and 88-11. These evaluations are discussed in Section 4.3.3.2 and Section 4.3.3.3, respectively.

4.3.2 Non-Class 1 Fatigue

Each mechanical system reviewed as part of the IPA and reported in Sections 3.2 through 3.4 was also screened to identify potential metal fatigue TLAA. This was accomplished using a screening process to identify non-Class 1 components that may have normal/upset condition operating temperature in excess of 220^{o}F for carbon steel or 270^{o}F for austenitic stainless steel. Results of the TLAA fatigue review for non-Class 1 mechanical systems within the scope of license renewal are presented below.

Piping and In-Line Components

Mechanical systems containing piping components that exceed the screening criteria listed above are primary sampling, low pressure safety injection/shutdown cooling, containment spray, chemical volume and control, emergency diesel generator, alternate AC diesel generator, containment penetrations, main feedwater, main steam, emergency feedwater, and blowdown/ steam generator secondary.

The piping components that exceed the screening criteria were designed to ANSI B31.1, which does not require an explicit fatigue analysis but specifies allowable stress levels based on the number of anticipated thermal cycles. Specifically, a stress reduction is not required in the design of piping that is not expected to experience more than 7,000 cycles. These piping components were evaluated for their potential to exceed 7,000 thermal cycles in sixty years of plant operation. Only the RCS hot leg sampling piping may exceed 7,000 cycles during the period of extended operation. However, a calculation was revised to justify RCS sampling to occur at any reasonable frequency for 60 years of operation without exceeding the allowable number of cycles. Therefore, fatigue analyses for all non-Class 1 components at ANO-2 remain valid for the period of extended operation, in accordance with 10CFR54.21(c)(1)(i).

Pressure Vessels, Heat Exchangers, Storage Tanks and Pumps

Only non-Class 1 pressure vessels, heat exchangers, storage tanks, and pumps designed and fabricated in accordance with ASME Section VIII Division 2 or ASME Section III NC-3200 require evaluation for thermal fatigue. Fatigue evaluation is not required for other design codes (e.g., ASME Section VIII Division 1, AWWA, MSS), and components designed and fabricated with these codes are suitable for the period of extended operation without further evaluation.

Engineering evaluations identified no non-Class 1 pressure vessels, heat exchangers, storage tanks or pumps requiring evaluation for thermal fatigue.

4.3.3 Response to Industry Experience

The nuclear industry reviews events that occur at nuclear power plants and new findings discovered by research. Industry experience and new research have found fatigue issues such as thermal stratification and environmentally-assisted fatigue that were not considered in the original plant design. Some of these findings impacted the fatigue analysis and resulted in the issuance of NRC generic communications. The concerns that are directly related to metal fatigue are discussed in the following sections.

4.3.3.1 (GSI-190) Environmentally-Assisted Fatigue

Recent test data indicate that certain environmental effects (such as temperature, oxygen, and strain rate) in the primary systems of light water reactors (LWR) could result in greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Section III design fatigue curves. The ASME design fatigue curves were based on laboratory tests in air at low temperatures. Although the failure curves derived from laboratory tests were adjusted to account for effects such as data scatter, size effect, and surface finish, the NRC is concerned that these adjustments may not be sufficient to account for actual plant operating environments.

The NRC implemented a fatigue action plan to systematically assess fatigue issues in operating plants. The results of the fatigue action plan were documented in SECY-95-245. As reported in SECY-95-245, the NRC believes that no immediate staff or licensee action is necessary to deal with the fatigue issues addressed by the fatigue action plan. In addition, the staff concluded that it could not justify requiring a backfit of the environmental fatigue data to operating plants. However, the NRC concluded that because metal fatigue effects increase with service life, the action plan fatigue issues should be evaluated for any proposed extended period of operation for license renewal. Specifically, as part of the resolution of GSI-166, which resulted in the initiation of GSI-190, the NRC will consider the need to evaluate a sample of components of high fatigue usage using the latest available environmental fatigue data. This is intended to ensure that components will continue to perform their intended functions during the period of extended operation associated with license renewal.

As a part of the effort to close GSI-166 (GSI-166 resulted in GSI-190) for operating nuclear power plants during the current 40-year license term, Idaho National Engineering Laboratory (INEL) evaluated fatigue-sensitive component locations at plants designed by the four U.S. nuclear steam supply system vendors. NUREG/CR-6260 provides the results of those evaluations. Section 5.2 of NUREG/CR-6260 identified the following component locations to be most sensitive to environmental effects for older Combustion Engineering plants. These locations and the subsequent calculations are directly relevant to ANO-2.

1) Reactor vessel shell and lower head

2) Reactor vessel inlet and outlet nozzles

3) Surge line

4) Charging nozzle

5) Safety injection nozzle

6) Shutdown cooling system Class 1 piping

The evaluation of the six limiting locations for the current term of operation (40-years) and the period of extended operation (60-years) is summarized in NUREG/CR-6260, Table 5-43. Of the six limiting locations evaluated, the only one for which the cumulative usage factor exceeded 1.0 when extrapolated to 60 years is the pressurizer surge line. However, the evaluations contained in NUREG/CR-6260 used the interim fatigue curves published in NUREG/CR-5999, which have been superseded by the fatigue curves reported in NUREG/CR-6717 (Reference 4.3-6). Therefore, assessment of environmental effects for the limiting six locations must be reevaluated for ANO-2 using the fatigue life correction factors reported in NUREG/CR-6717, Section 5.3.

The limiting locations listed above are evaluated for environmental effects in accordance with the guidance provided in NUREG-1801, using the fatigue life correction factors reported in NUREG/CR-6717, Section 5.3. The limiting vessel locations are made of low-alloy steel, the safety injection and charging nozzles are made of carbon steel, and the shutdown cooling system piping and pressurizer surge line piping are stainless steel. Using NUREG/CR-6717, the bounding fatigue life correction factor for low alloy steel, carbon steel, and stainless steel are 2.5, 1.74, and 15.4, respectively.

The revised usage factors when including these environmental correction factors are summarized below.

NUREG-6260 Item	Usage Factor	Usage Factor with Env. Correction Factor
Reactor vessel head-to-shell juncture (low-alloy steel)	0.003	0.0075
Reactor vessel outlet nozzle (low-alloy steel)	0.0889	0.2223
Reactor vessel inlet nozzle (low-alloy steel)	0.1388	0.347
Pressurizer surge line (stainless steel)	0.9895	15.24
Charging nozzle (carbon steel)	0.78	1.357
Safety injection nozzle (carbon steel)	0.3755	0.6534
Shutdown cooling line (stainless steel)	0.6448	9.930

For the charging nozzle, shutdown cooling line piping, and pressurizer surge line piping, more detailed stress analyses or fatigue monitoring and cycle counting would have to be used to reduce the CUF below 1.0. Due to the factor of safety included in the ASME code, a CUF of greater than 1.0 does not indicate that fatigue cracking is expected. However, there is a potential for fatigue cracking during the period of extended operation at locations having CUFs exceeding 1.0. Therefore, prior to entering the period of extended operation, for each location that may exceed a CUF of 1.0 when considering environmental effects, an approach will be developed to show that the effects of fatigue can be managed. The approach for addressing environmental fatigue for the above locations will include one or more of the following:

(1) Further refinement of the fatigue analysis to lower the CUFs to below 1.0, or

(2) Repair of the affected locations, or

(3) Replacement of the affected locations, or

(4) Manage the effects of fatigue of the locations by an inspection program that has been reviewed and approved by the NRC (for example, periodic non-destructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC). The inspections are expected to be able to detect cracking due to thermal fatigue prior to loss of

function. Replacement or repair will then be implemented such that the intended function will be maintained for the period of extended operation, or

(5) Monitor ASME Code activities to use the environmental fatigue methodology approved by the code committee and NRC.

Should ANO-2 select Option 4 (inspection) to manage environmentally-assisted fatigue during the period of extended operation, details such as scope, qualification, method, and frequency will be provided to the NRC prior to entering the period of extended operation.

The effects of environmental-assisted thermal fatigue for the limiting locations identified in NUREG-6260 have been evaluated for ANO-2 in accordance with 10CFR54.21(c)(1) (i and ii) and all locations are acceptable for the period of extended operation with the exception of the charging nozzle, shutdown cooling line, and pressurizer surge line. Cracking by environmentally-assisted fatigue of these locations is addressed using one of the five approaches previously discussed in accordance with 10CFR54.21(c)(1).

4.3.3.2 NRC Bulletin 88-08, Thermal Stresses in Piping Connected to Reactor Coolant Systems

NRC Bulletin 88-08 identified a concern regarding potential temperature stratification or temperature oscillations in unisolable sections of piping attached to the RCS. Entergy provided to the NRC the responses required by Bulletin 88-08 and its supplements (References 4.3-1 and 4.3-2).

Based on the Entergy responses, the NRC staff found that ANO-2 met the requirements of NRC Bulletin 88-08 (Reference 4.3-7). Commitments regarding inspections at ANO-2 in response to NRC Bulletin 88-08 have been superseded by the risk-informed inspection (RI-ISI) of ASME Class 1 piping, as approved by the NRC (References 4.3-8, 4.3-9, 4.3-10, and 4.3-11). Although aging effects due to thermal stratification as described in Bulletin 88-08 are not expected, the absence of cracking due to thermal fatigue will be confirmed by inspections as part of the inservice inspection program in accordance with 10CFR54.21(c)(1)(iii) through the period of extended operation.

4.3.3.3 NRC Bulletin 88-11, Pressurizer Surge Line Thermal Stratification

Pressurizer surge line thermal stratification was an issue raised by NRC Bulletin 88-11. One of the requirements of this bulletin was to analyze the effects of this mechanism on the stress and fatigue calculations for the surge line. A generic and bounding analysis for all CE plants was performed by CE and submitted to the NRC. To address this issue for the purposes of license renewal, the pressurizer surge line bounding locations will be included in the fatigue monitoring program. Therefore, realistic fatigue usage for the surge line will be tracked, and actions will be taken to reevaluate, repair, or replace the surge line before a fatigue-induced failure occurs. The effects of aging will be managed in accordance with 10CFR54.21(c)(1)(iii) for the period of extended operation.

4.3.4 References for Section 4.3

4.3-1 Letter from Dan R. Howard (EOI) to USNRC (0CAN108806), Arkansas Nuclear One – Units 1 & 2, Docket Nos. 50-313 and 50-368, License Nos. DPR-51 and NPF-6, NRC Bulletin No. 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems, October 12, 1988.

4.3-2 Letter from James J. Fisicaro (EOI) to USNRC (0CAN019102), Arkansas Nuclear One – Units 1 & 2, Docket Nos. 50-313 and 50-368, License Nos. DPR-51 and NPF-6, NRC Bulletin No. 88-08: Thermal Stresses in Piping Connected to Reactor Coolant Systems, January 31, 1991.

4.3-3 SECY-95-245, "Completion of Fatigue Action Plan", September 25, 1995.

4.3-4 GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life".

4.3-5 NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, March 1995.

4.3-6 NUREG/CR-6717, *Environmental Effects on Fatigue Crack Initiation in Piping and Pressure Vessel Steels*, May 2001.

4.3-7 Letter from Sheri Peterson (NRC) to Neil S. Carns (EOI) (2CNA099106), NRC Bulletin 88-08, Thermal Stresses in Piping Connected to Reactor Coolant Systems – Arkansas Nuclear One, Unit 2 (ANO-2) (TAC No. 69597), September 26, 1991.

4.3-8 Letter from Dwight C. Mims (EOI) to USNRC (2CAN099706), Arkansas Nuclear One – Unit 2, Docket 50-368, License No. NPF-6, Risk-Informed Inservice Inspection Pilot Plant Submittal for ANO-2, September 30, 1997.

4.3-9 Letter from Jimmy D. Vandergrift (EOI) to USNRC (2CAN109801), Arkansas Nuclear One – Unit 2, Docket 50-368, License No. NPF-6, Additional Information in Support of the Risk-Informed Inservice Inspection Pilot Application, October 8, 1998.

4.3-10 Letter from Jimmy D. Vandergrift (EOI) to USNRC (2CAN119804), Arkansas Nuclear One – Unit 2, Docket 50-368, License No. NPF-6, Information to Support Risk-Informed Inservice Inspection Pilot Application, November 25, 1998.

4.3-11 Letter from John N. Hannon (NRC) to C. Randy Hutchinson (EOI) (2CNA129805), Request to Use Risk Informed Alternative to the Requirements of ASME Code Section XI, Table IWX-2500 at Arkansas Nuclear One, Unit No. 2 (TAC No. M99756), December 29, 1998.

4.3-12 Combustion Engineering Report CEN-387-P, *Pressurizer Surge Line Flow Stratification Evaluation*, Revision 1.

4.3-13 Letter from Thomas W. Alexion (NRC) to Jerry W. Yelverton (EOI) (2CNA079307), Safety Evaluation for Combustion Engineering Owners Group Report CEN-387-P, Revision 1, Pressurizer Surge Line Thermal Stratification Evaluation (NRC Bulletin 88-11) (TAC No. M72109), July 23, 1993.

4.3-14 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, April 2001.

Table 4.3-1
RCS Design Transients

Design Transient	Number of Design Cycles	Number of Transient Cycles Logged as of 7/11/02	Projected Number of Transient Cycles at 60 Years of Operation (1)
RCS heatup or cooldown w/o SGs	500	85	216
Heatup or cooldown of SGs	350	4	135
Pressurizer MNSA-2 Grp 1(2)	10	1	NA
Pressurizer MNSA-2 Grp 2(2)	10	0	NA
Unit loading or unloading at 5%/min of full power, excluding SGs	15000	Not required to be monitored	
Unit loading or unloading at 5%/min of full power, applies to SGs	12000	Not required to be monitored	
Normal plant variations(3)	10^6	Not required to be monitored	
RCS hydrostatic test(4)	10	1	3
RCS leak test(5)	200	0	0
Reactor trip from 100%	400	77.14	196
Turbine trip with delayed reactor trip	40	1	3
Loss of reactor coolant flow at 100%	40	2.91	8
Seismic event (stress cycles)	200	0	0
Complete loss of secondary pressure	5	0	0
Pressurizer spray cycles (with pressurizer and spray water temperature $\Delta T > 200F$)	100/yr (4000 total)	238	605

1. Projected cycles for all transients except SG heatup or cooldown = cycles as of July 11, 2002 ∗ 2.54. Numbers are rounded up to the nearest whole number. The projected cycles for SG heatup or cooldown are 135 = 216 - (85 - 4).

2. The pressurizer MNSA-2 Grp 1 and -2 Grp 2 are not design transients but rather mechanical clamp designations associated with the pressurizer. The design cycles that are listed (10 cycles) are associated with the RCS heatup or cooldown transient. Because these components have limited life, they are not subject to aging management review for license renewal. These cycles are tracked for fatigue purposes and will be used to determine when components require replacement or fatigue reassessment.

3. This transient includes 10% step load increase and decrease.

4. Ten hydrostatic tests were originally specified. There has only been one performed. Section XI of the ASME Code permits leak tests in lieu of hydrostatic tests. Therefore, hydrostatic tests are no longer required to be analyzed for fatigue requirements.

5. Leak testing for the reactor vessel and other RCS components was originally specified as 200 occurrences. Leak testing currently comes under Section XI of the ASME Code and is performed at hot standby. Leak testing no longer needs to be separately categorized for fatigue purposes.

4.4 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL COMPONENTS

The ANO-2 environmental qualification (EQ) of electrical components program manages component thermal, radiation and cyclical aging, as applicable, through the use of aging evaluations based on 10CFR50.49(f) qualification methods. As required by 10CFR50.49, 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 TLAA for license renewal. The EQ program ensures that these EQ components are maintained in accordance with their qualification bases.

The ANO-2 program is an existing program established to meet ANO-2 commitments for 10CFR 50.49. It is consistent with NUREG-1801, Section X.E1, “Environmental Qualification (EQ) of Electric Components”.

The ANO-2 program includes consideration of operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10CFR50.49 provides reasonable assurance that components can perform their intended function(s) during accident conditions after experiencing the effects of inservice aging. Consistent with NRC guidance provided in RIS 2003-09, no additional information is required to address GSI-168, “EQ of Electrical Components”.

Based upon a review of the existing program and associated operating experience, continued implementation of the ANO-2 environmental qualification of electrical components program provides reasonable assurance that the aging effects will be managed and that the in-scope EQ components will continue to perform their intended function(s) for the period of extended operation. The effects of aging will be managed by the ANO-2 program in accordance with the requirements of 10CFR54.21(c)(1)(iii).

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS

Loss of prestress in the containment post-tensioning system is due to material strain occurring under constant stress. The analysis of loss of prestress over the initial 40-year license term is discussed in SAR Section 3.8.1.3.4, and is a time-limited aging analysis requiring review for license renewal.

By assuming an appropriate initial stress from tensile loading and using appropriate pre-stress loss parameters, the magnitude of the design losses and the final effective prestress at the end of 40 years for typical dome, vertical, and hoop tendons was calculated at the time of initial licensing and following steam generator replacement activities. A structural proof test was performed to verify the adequacy of the containment building design. Loss of tendon prestress in the containment building post-tensioning system will be managed for license renewal by the Containment Inservice Inspections. IWL Inservice Inspections include tendon surveillance testing. ANO-2 tendon surveillance procedures incorporate the requirements of ASME Code Section XI, Subsection IWL and 10CFR50.55(a).

Calculation of the effective prestress of the containment post-tensioning system at 60 years has been performed and shows the containment tendons will be acceptable for the period of extended operation. In addition, the Containment Inservice Inspections will be adequate to manage the effects of aging on the containment post-tensioning system for the period of extended operation. Therefore, this TLAA has been determined acceptable in accordance with 10CFR54.21(c)(1)(ii) and (c)(1)(iii).

4.6 CONTAINMENT LINER PLATE AND PENETRATION FATIGUE ANALYSES

The interior surface of the containment is lined with welded carbon steel plate to provide an essentially leak tight barrier. At the penetrations, the containment liner plate is thickened to reduce stress concentrations. The criteria in SAR Sections 3.8.1.3.4 and 3.8.1.6.3 were applied to the containment design to ensure that the integrity of the liner plate is not exceeded under design basis accident conditions. The evaluation of this issue for license renewal is based on an analytical assessment of the containment liner and penetrations as described in SAR Section 3.8.1.4.2 and the results of recently completed containment liner plate evaluations for ANO-2. TLAA for the ANO-2 reactor containment structure include containment liner and containment penetration fatigue analyses.

Mechanical penetrations are leak-tight, welded assemblies. As described in SAR Section 3.8.1.4.2, containment penetrations are designed to meet the requirements of ASME Section III. The evaluation for mechanical penetrations covers the penetration assembly and the weld to the process piping, but does not include the process piping within the penetration. The closure of the pipe to the liner plate is accomplished with special heads welded to the pipe and the liner plate reinforcement. Penetration anchorage to the containment wall is designed to resist pipe rupture, seismic and thermal loads.

Liner plate stress analyses indicate a conservative maximum stress of approximately 30 ksi for worst case (DBA) conditions. Stresses from normal operating cycles such as heatup and cooldown are less than 30 ksi. Using ASME Section III, Division 1 design fatigue curve, at 30 ksi the maximum cycles for the liner would be approximately 25,000. The number of normal operating cycles for the liner plate will be well below this value. On this basis, the liner plate and penetrations are suitable for the cyclic loads of normal operating conditions throughout the period of extended operation.

For license renewal, containment liner plate and penetration fatigue analyses remain valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i).

4.7 OTHER PLANT-SPECIFIC TIME-LIMITED AGING ANALYSES

Other potential plant-specific TLAA include leak-before-break (LBB) analyses, fracture mechanics evaluation of the RCP casing and flywheel, steam generator flow-induced vibration analysis, qualification analyses of alloy 600 nozzle repairs and high energy line break analyses.

4.7.1 RCS Piping Leak-Before-Break

The NRC modified 10CFR50 general design criterion (GDC) 4 in 1987. This change allows licensees to disregard the dynamic effects of postulated ruptures in primary coolant loop piping in the design of pressurized water reactors if leak before break (LBB) criteria are met. In 1990, a LBB analysis (Topical Report CEN-367-A) was performed for Combustion Engineering-designed nuclear steam supply systems (NSSS) (Reference 4.7-1). This analysis demonstrated that potential leaks in the RCS primary loop piping can be detected by plant monitoring systems before a postulated crack causing the leak would grow to unstable proportions during the 40-year plant life. This analysis was approved by the NRC in its safety evaluation dated October 30, 1990 (Reference 4.7-5). The original design basis for the ANO-2 reactor coolant system considered postulated breaks for the purposes of evaluating for protection from the dynamic and environmental effects of the main coolant line (MCL) breaks. The changes to GDC 4 allowed the application of LBB criteria for the selection of MCL breaks. The criteria have been approved for use at ANO-2 through the NRC safety evaluation dated June 18, 1996 (Reference 4.7-2). This application of LBB has eliminated the requirement to consider postulated breaks on the MCL for purposes of evaluating the dynamic effects on the RCS. The original LBB analysis was updated for the steam generator replacement and power uprate to demonstrate that conclusions of the original analysis remain valid.

The analysis consideration that could be time-limited is the accumulation of fatigue transient cycles over time that could invalidate the fatigue crack growth analysis reported in CEN-367-A, Section 3.0. The crack growth rate laws were evaluated for the fatigue transients presented in CEN-367-A, Table 3-1. A review of the ANO-2 fatigue transient cycle definitions has been completed in Section 4.3.1 where the fatigue monitoring program has been demonstrated capable of monitoring the Class 1 thermal fatigue design basis transients for the period of extended operation, including the transient assumptions reported in CEN-367-A.

A review of CEN-367-A identified the fatigue crack growth analysis as a TLAA. Continued implementation of the ANO-2 fatigue monitoring program provides reasonable assurance that the fatigue crack growth analysis reported in CEN-367-A will remain valid during the period of extended operation. The LBB TLAA remains valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i).

4.7.2 RCP Code Case N-481

Demonstration of compliance of the primary loop pump casings to ASME Code Case N-481 was evaluated for ANO-2. This analysis considers thermal aging of the cast austenitic stainless steel

(CASS) pump casings and fatigue crack growth. Because these evaluations could be influenced by time, the Code Case N-481 analysis is a potential TLAA.

The first analysis consideration that could be time-limited is the material properties of cast austenitic stainless steel. Cast austenitic stainless steels used in the reactor coolant system are subject to thermal aging during service. Since the Code Case N-481 analysis relied on fully aged (saturated) stainless steel material properties, the analysis does not have a material property time dependency that requires further evaluation for license renewal.

In addition, the accumulation of actual fatigue transient cycles over time could invalidate the fatigue crack growth analysis of the ANO-2 Code Case N-481 evaluation. A review of the ANO-2 fatigue transient cycle definitions has been discussed in Section 4.3.1 where the fatigue monitoring program has been demonstrated to adequately monitor thermal fatigue design transients, including the transient cycle assumptions reported in the ANO-2 Code Case N-481 evaluation, for the period of extended operation. The continued implementation of the fatigue monitoring program provides reasonable assurance that the ANO-2 Code case N-481 fatigue crack growth analysis will remain valid during the period of extended operation in accordance with 10CFR 54.21(c)(1)(i).

4.7.3 RCP Flywheel

The reactor coolant pump motors have flywheels to increase rotational-inertia, thus prolonging pump coastdown and assuring a more gradual loss of main coolant flow to the core in the event that pump power is lost. The flywheel is mounted on the upper end of the rotor, below the upper radial bearing and inside the motor frame. The aging effect of concern is fatigue crack initiation and growth in the flywheel bore key way from stresses due to starting the motor.

In an effort to reduce the RCP flywheel inspection frequency and scope, ANO-2 submitted an amendment request in 1995 based on topical report. This topical includes a stress and fracture evaluation which addresses fatigue crack growth. The NRC approved this request in 1997 (Reference 4.7-4). In this topical, fatigue crack growth is based on 4,000 cycles of reactor coolant pump startups and shutdowns rather than on the current operating term of 40 years. Since plant outages occur at an average of less than one per year and RCP starts occur rarely other than for plant startup, the limit of 4,000 cycles will not be approached during a 60-year plant license term. Since the analysis of fatigue crack initiation and growth on the RCP flywheel does not involve time-limited assumptions defined by the current operating term, it is not a time-limited aging analysis.

4.7.4 Steam Generator Tubes – Flow-Induced Vibration

TLAA applicable to the steam generators include analysis of steam generator tube flow-induced vibration (FIV). As the ANO-2 steam generators were installed in 2000, their design life extends to 2040. This exceeds the period of extended operation sought through this license renewal application. Therefore, the steam generator FIV analysis remains valid for the period of extended operation in accordance with 10CFR 54.21(c)(1)(i).

4.7.5 Alloy 600 Nozzle Repairs

In 2000, NDE evaluations revealed that a number of pressurizer heater penetrations, as well as resistance temperature detector (RTD) and pressure measurement nozzle penetrations on the RCS hot leg had developed leaks. The repair for the pressurizer heater penetration replaced the pressure boundary weld on the inside surface of the pressurizer nozzle with an outer diameter (OD) weld attached to a temper-bead weld pad on the pressurizer OD. The hot leg piping penetration modification consisted of removing a portion of the old RTD or pressure tap by cutting it near the outer wall of the RCS piping and replacing it with a new nozzle welded on the outside surface of the RCS piping. A fracture mechanics evaluation was performed to evaluate the potential for a crack in the remaining pressurizer and RCS hot leg penetration welds to propagate into the pressurizer vessel or hot leg pipe wall. The crack growth evaluations utilized operating transient cycles which were assumed for a 40-year plant lifetime. To prevent further penetration leakage, all primary piping RTD nozzles at ANO-2 were replaced. The replacement nozzles and attachment welds were qualified for structural adequacy in accordance with ASME code criteria. This analysis included a simplified fatigue evaluation which considered cyclic loads due to pressure, thermal gradients, and mechanical loads.

As discussed in Section 4.3.1, a review of the ANO-2 fatigue transient cycle definitions has been completed. The fatigue monitoring program will monitor thermal fatigue design basis transients, including those assumed in the analysis of the Alloy 600 nozzle repairs for the period of extended operation. The continued implementation of the fatigue monitoring program provides reasonable assurance that the fatigue crack growth analysis for the repairs will remain valid during the period of extended operation. Similarly, the fatigue analysis for the replacement nozzles and attachment welds remains valid for the period of extended operation. This result demonstrates that the Alloy 600 nozzle repairs TLAA remain valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i).

4.7.6 High Energy Line Break Analyses

In accordance with 10CFR50 General Design Criterion No. 4, "Environmental and Missile Design Bases," special measures have been taken in the design and construction of ANO-2 to protect structures, systems, and components required to place the reactor in a safe cold shutdown condition from the dynamic effects associated with the postulated rupture of piping. Regulatory Guide 1.46, "Protection Against Pipe Whip Inside Containment" was the basic document used in establishing the design criteria for piping systems inside containment. As defined in SAR Section 3.6.2.1, the postulated break locations for ASME Section III Class 1 piping were determined, in part, using any intermediate locations between terminal ends where the cumulative usage factor derived from the piping fatigue analysis under the loadings associated with specified seismic events and operational plant conditions exceeded 0.1 (Reference 4.7-3). As discussed in Section 4.3, these fatigue evaluations are TLAA since they are based on a set of design transients that are based on the life of the plant. Fatigue evaluations for Class 1 mechanical components at ANO-2 are described in Section 4.3.1 which demonstrates that there is ample margin between the projected and analyzed number of thermal cycles for all Class 1 components for the period of extended operation. Therefore, the analyzed usage factors utilized for the current HELB location determinations remain valid for the period of extended operation. In addition, ANO-2 monitors transient cycles that contribute to fatigue usage in accordance with requirements in the ANO-2 Technical Specifications, Section 6.8.4(b). The continued implementation of the ANO-2 fatigue monitoring program, which is discussed in Appendix B, provides reasonable assurance that the ANO-2 HELB analyses will remain valid during the period of extended operation. This result demonstrates that the HELB TLAA remains valid for the period of extended operation in accordance with 10CFR54.21(c)(1)(i).

4.7.7 References for Section 4.7

4.7-1 CEN-367-A, *Leak-Before-Break Evaluation of Primary Coolant Piping*, May 1992.

4.7-2 Kalman, George (NRC), Letter to Jerry W. Yelverton (EOI) (2CNA069601), Containment Leak Detection Capabilities With Permanent Reactor Vessel Seal Plate at Arkansas Nuclear One, Unit 2, June 18, 1996.

4.7-3 Arkansas Nuclear One - Unit 2 Safety Analysis Report, Amendment 17.

4.7-4 Sheron, Brian W. (NRC), Letter to Dwight C. Mims (EOI) (0CNA059718), Acceptance for Referencing of Topical Report SIR-94-080, “Relaxation of Reactor Coolant Pump Flywheel Inspection Requirements”, May 21, 1997.

4.7-5 Richardson, James E. (NRC), Letter to Edward C. Sterling (CEOG), Acceptance for Referencing Topical Report CEN-367, “Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Design Nuclear Steam Supply Systems”, October 30, 1990.