Safety Evaluation Report

With Open Items Related to the License Renewal of Crystal River Unit 3 Nuclear Generating Plant

Docket No. 50-302

Florida Power Corporation

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

December 2010

ABSTRACT

This safety evaluation report (SER) documents the technical review of the Crystal River Unit 3 Nuclear Generating Plant (CR-3) license renewal application (LRA) by the United States (U.S.) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated December 16, 2008, Florida Power Corporation (FPC or the applicant) submitted the LRA in accordance with Title 10, Part 54, of the *Code of Federal Regulations*, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." FPC requests renewal of CR-3 operating license (Facility Operating License Number DPR-72) for a period of 20 years beyond the current expiration at midnight December 3, 2016.

CR-3 is located approximately 35 miles southwest of Ocala, Florida. The NRC issued the construction permit for CR-3 on September 25, 1968. The NRC issued the operating license for CR-3 on January 28, 1977. CR-3 employs a pressurized water reactor design with a dry ambient containment. Babcock and Wilcox Corporation supplied the nuclear steam supply system. Gilbert Associates designed the balance of the plant and J. A. Jones was the constructor. The licensed power output is 2,609 megawatt thermal (MWt) with a gross electrical output of approximately 900 megawatt electric (MWe).

This SER presents the status of the staff's review of information submitted through November 12, 2010, the cutoff date for consideration in the SER. SER Section 6 provides the staff's final conclusion of its LRA review. The staff identified nine open items and two confirmatory items that must be resolved before any final determination on the LRA. SER Sections 1.5 and 1.6, for open items and confirmatory items, respectively, summarize these items. The staff will present its final conclusion on the LRA review in an update to this SER.

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ACRONYMS AND ABBREVIATIONS

AAC	Alternate AC
AB	auxiliary building
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Document Access and Management System
ADV	atmospheric dump valve
AERM	aging effect requiring management
AFW	auxiliary feedwater
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
AMSAC	ATWS (anticipated transient without scram mitigating system actuation circuitry)
ANL	Argonne National Laboratories
ANSI	American National Standards Institute
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
B_4C	carborundum
B&PV	boiler and pressure vessel
B&W	Babcock & Wilcox
BEST	backup engineered safeguards transformer
BTP	branch technical position
BWR	boiling water reactor
BWST	borated water storage tank
BWSTF	borated water storage tank foundation

CA	chemical addition
CASS	cast austenitic stainless steel
CC	control complex
CEA	control element assembly
CFR	*Code of Federal Regulations*
cft	cubic feet
CLB	current licensing basis
CMTR	certified material test report
CR-3	Crystal River Unit 3 Nuclear Generating Plant
CRD	control rod drive
CRDM	control rod drive mechanism
CRGT	control rod guide tube
CST	condensate storage tank
Cu	copper
CUF	cumulative usage factor
CVCS	chemical and volume control
C_VUSE	Charpy upper-shelf energy
DBA	design basis accident
DBE	design basis event
DC	direct current
ECCS	emergency core cooling system
EDG	emergency diesel generator
EFIC	emergency feedwater initiation and control
EFP	emergency feedwater pump
EFPB	emergency feedwater pump building
EFPY	effective full-power year
EFW	emergency feedwater
EHC	electro-hydraulic control

EIC	electrical and instrumentation and control
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	Environmental report (Applicant's Environmental Report Operating License Renewal Stage)
ES	engineered safeguards
ESF	engineered safety features
FAC	flow-accelerated corrosion
F_{en}	environmental fatigue life correction factor
FERC	Federal Energy Regulatory Commission
FIV	flow-induced vibrations
FPC	Florida Power Corporation
FR	*Federal Register*
FSAR	final safety analysis report
ft-lb	foot-pound
GALL	Generic Aging Lessons Learned
GDC	general design criteria or general design criterion
GEIS	Generic Environmental Impact Statement
GL	generic letter
GSI	generic safety issue
HELB	high-energy line break
HP	health physics
HPI	high-pressure injection
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
IA	instrument air

IASCC	irradiation assisted stress-corrosion cracking
IB	intermediate building
ID	inside diameter
IEEE	Institute of Electrical and Electronics Engineers
IGA	intergranular attack
IGSCC	intergranular stress-corrosion cracking
ILRT	integrated leak rate testing
IN	information notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
ksi	kilopounds per square inch
KV or kV	kilovolt
LBB	leak-before-break
LiOH	lithium hydroxide
LOCA	loss of coolant accident
LOOP	loss of offsite power
LPI	low-pressure injection
LRA	license renewal application
LRBD	license renewal boundary drawing
LTOP	low-temperature overpressure protection
MD	miscellaneous drains
MeV	megaelectron volts
MFP	main feedwater pump
MFW	main feedwater
MIC	microbiologically-influenced corrosion
MS	main steam

MSIV	main steam isolation valve
MU	makeup
MU&P	makeup and purification
MUR	measurment uncertainty recapture
MWe	megawatt electric
MWt	megawatt thermal
NA	not applicable
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
Ni	nickel
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system
O_2	oxygen
OD	outside diameter
ODSCC	outside-diameter stress-corrosion cracking
OE	operating experience
OI	open item
OPT	offsite power transformer
OTSG	once-through steam generator
PASS	post-accident sampling system
pH	potential of hydrogen
PORV	power-operated relief valve
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
RAI	request for additional information
RB	reactor building
RCCA	rod cluster control assembly
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RISI	risk-informed inservice inspection
RPV	reactor pressure vessel
RT_{NDT}	reference temperature nil ductility transition
RT_{PTS}	reference temperature for pressurized thermal shock
RV	reactor vessel
RVCH	reactor vessel closure head
RVI	reactor vessel internal
SBO	station blackout
SC	structure and component
SCC	stress-corrosion cracking
SER	safety evaluation report
SFPC	spent fuel pit/pool cooling, spent fuel pit and cooling
SG	steam generator
SGTR	steam generator tube rupture

SO_2	sulfur dioxide
SOC	statement of consideration
SPU	stretch power uprate
SRP	Standard Review Plan
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SSC	system, structure, and component
SSE	safe-shutdown earthquake
S_y	yield strength
SW	service water
TB	turbine building
TLAA	time-limited aging analysis
TS	technical specification
TSTF	technical specifications task force traveler
TSP-C	trisodium phosphate dodecahydrate
U.S.	United States
UCC	underclad cracking
USACE	U.S. Army Corps of Engineers
USE	upper-shelf energy
USGS	U.S. Geological Survey
UT	ultrasonic testing
UV	ultraviolet
VT	visual testing
WEPS	wave embankment protection structure
WGDT	waste gas decay tank
yr	year

Zn	zinc
1/4 T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Crystal River Unit 3 Nuclear Generating Plant (CR-3), as filed by Florida Power Corporation (FPC or the applicant). By letter dated December 16, 2008, FPC submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the CR-3 operating license for an additional 20 years. The NRC staff (the staff) prepared this report to summarize the results of its safety review of the LRA for compliance with Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54). The NRC project manager for the license renewal review is Robert Kuntz. Mr. Kuntz may be contacted by telephone at 301-415-3733, or by electronic mail at Robert.Kuntz@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
US Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Robert Kuntz, Mail Stop O11-F1

In its December 16, 2008, submission letter, the applicant requested renewal of the operating license issued under Section 104b (Operating License No. DPR-72) of the Atomic Energy Act of 1954, as amended, for CR-3 for a period of 20 years beyond the current expiration at midnight December 3, 2016. CR-3 is located approximately 35 miles southwest of Ocala, Florida. The NRC issued the construction permit for CR-3 on September 25, 1968. The NRC issued the operating license for CR-3 on January 28, 1977. CR-3 employs a pressurized water reactor design with a dry ambient containment. Babcock and Wilcox Corporation supplied the nuclear steam supply system. Gilbert Associates designed the balance of the plant and J. A. Jones was the constructor. The licensed power output is 2,609 megawatt thermal (MWt) with a gross electrical output of approximately 900 megawatt electric (MWe). The final safety analysis report (FSAR) contains details of the plant and the site.

The license renewal process consists of two concurrent reviews, a technical review of safety issues, and an environmental review. The NRC regulations in 10 CFR Part 54 and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," respectively, set forth requirements for these reviews. The safety review for the CR-3 license renewal is based on the applicant's LRA and on its responses to the staff's requests for additional information (RAIs). The applicant supplemented the LRA and provided clarifications through its responses to the staff's RAIs in audits, meetings, and docketed correspondence. Unless otherwise noted, the staff reviewed and considered information submitted through November 12, 2010. The staff reviewed information received after that date depending on the stage of the safety review and the volume and complexity of the information. The public may view the LRA and all pertinent information and materials at the NRC Public Document Room, located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD 20852-2738 (301-415-4737 / 800-397-4209), and the LRA at the Coastal Region

Library, 8619 W. Crystal St., Crystal River, FL 34428-4468. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC Web site at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005.

SER Sections 2 through 4 address the staff's evaluation of license renewal issues considered during the review of the application. SER Section 5 is reserved for the report of the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this SER are in Section 6.

SER Appendix A is a table showing the applicant's commitments for renewal of the operating license. SER Appendix B is a chronology of the principal correspondence between the staff and the applicant regarding the LRA review. SER Appendix C is a list of principal contributors to the SER and Appendix D is a bibliography of the references in support of the staff's review.

In accordance with 10 CFR Part 51, the staff will prepare a draft, plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." This supplement will discuss the environmental considerations for license renewal for CR-3. The staff is scheduled to issue the draft, plant-specific GEIS Supplement in January 2011. The final, plant-specific GEIS Supplement is scheduled to be issued in April 2011.

1.2 License Renewal Background

Pursuant to the Atomic Energy Act of 1954, as amended, and NRC regulations, operating licenses for commercial power reactors are issued for 40 years and can be renewed for up to 20 additional years. The original 40-year license term was selected based on economic and antitrust considerations rather than on technical limitations; however, some individual plant and equipment designs may have been engineered for an expected 40-year service life.

In 1982, the staff anticipated interest in license renewal and held a workshop on nuclear power plant aging. This workshop led the NRC to establish a comprehensive program plan for nuclear plant aging research. From the results of that research, a technical review group concluded that many aging phenomena are readily manageable and pose no technical issues precluding life extension for nuclear power plants. In 1986, the staff published a request for comment on a policy statement that would address major policy, technical, and procedural issues related to license renewal for nuclear power plants.

In 1991, the staff published 10 CFR Part 54, the License Renewal Rule (Volume 56, page 64943, of the *Federal Register* (56 FR 64943), dated December 13, 1991). The staff participated in an industry-sponsored demonstration program to apply 10 CFR Part 54 to a pilot plant and to gain the experience necessary to develop implementation guidance. To establish a scope of review for license renewal, 10 CFR Part 54 defined age-related degradation unique to license renewal; however, during the demonstration program, the staff found that adverse aging effects on plant systems and components are managed during the period of initial license and that the scope of the review did not allow sufficient credit for management programs, particularly the implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," which regulates management of plant-aging phenomena. As a result of this finding, the staff amended 10 CFR Part 54 in 1995. As published on May 8, 1995, in 60 FR 22461, amended 10 CFR Part 54 establishes a regulatory process that is simpler, more stable, and more predictable than the previous 10 CFR Part 54. In particular, as amended, 10 CFR Part 54 focuses on the management of adverse aging effects rather than on the identification of age-related degradation unique to license renewal. The staff made these rule changes to ensure that important systems, structures, and components (SSCs) will continue to perform their intended functions during the period of extended operation. In addition, the amended 10 CFR Part 54 clarifies and simplifies the integrated plant assessment process to be consistent with the revised focus on passive, long-lived structures and components (SCs).

Concurrent with these initiatives, the staff pursued a separate rulemaking effort (61 FR 28467, June 5, 1996) and amended 10 CFR Part 51 to focus the scope of the review of environmental impacts of license renewal in order to fulfill NRC responsibilities under the National Environmental Policy Act of 1969.

1.2.1 Safety Review

License renewal requirements for power reactors are based on two key principles:

(1) The regulatory process is adequate to ensure that the licensing bases of all currently operating plants maintain an acceptable level of safety with the possible exceptions of the detrimental aging effects on the functions of certain SSCs, as well as a few other safety-related issues, during the period of extended operation.

(2) The plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

In implementing these two principles, 10 CFR 54.4, "Scope," defines the scope of license renewal as including those SSCs that: (1) are safety-related, (2) whose failure could affect safety-related functions, or (3) are relied on to demonstrate compliance with NRC regulations for fire protection, environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transient without scram (ATWS), and station blackout (SBO).

Pursuant to 10 CFR 54.21(a), a license renewal applicant must review all SSCs within the scope of 10 CFR Part 54 to identify SCs subject to an aging management review (AMR). Those SCs subject to an AMR perform an intended function without moving parts or without change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. Pursuant to 10 CFR 54.21(a), a license renewal applicant must demonstrate that the aging effects will be managed such that the intended function(s) of those SCs will be maintained consistent with the current licensing basis (CLB) for the period of extended operation. However, active equipment is considered to be adequately monitored and maintained by existing programs. In other words, detrimental aging effects that may affect active equipment can be readily identified and corrected through routine surveillance, performance monitoring, and maintenance. Surveillance and maintenance programs for active equipment, as well as other maintenance aspects of plant design and licensing basis, are required throughout the period of extended operation.

Pursuant to 10 CFR 54.21(d), the LRA is required to include an FSAR supplement with a summary description of the applicant's programs and activities for managing aging effects and an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation.

License renewal also requires TLAA identification and updating. During the plant design phase, certain assumptions about the length of time the plant can operate are incorporated into design calculations for several plant SSCs. In accordance with 10 CFR 54.21(c)(1), the applicant must either show that these calculations will remain valid for the period of extended operation, project the analyses to the end of the period of extended operation, or demonstrate that the aging effects on these SSCs will be adequately managed for the period of extended operation.

In 2005, the NRC revised Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses." This RG endorses Nuclear Energy Institute (NEI) 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," issued in June 2005. NEI 95-10 details an acceptable method of implementing 10 CFR Part 54. The staff also used the SRP-LR to review the LRA.

In the LRA, the applicant fully used the process defined in NUREG-1801, Revision 1, "Generic Aging Lessons Learned (GALL) Report," dated September 2005. The GALL Report summarizes staff-approved aging management programs (AMPs) for many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for LRA review can be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used throughout the industry. The report is also a quick reference for both applicants and staff reviewers to AMPs and activities that can manage aging adequately during the period of extended operation.

1.2.2 Environmental Review

Part 51 of 10 CFR contains regulations on environmental protection. In December 1996, the staff revised the environmental protection regulations to facilitate the environmental review for license renewal. The staff prepared the GEIS to document its evaluation of possible environmental impacts associated with nuclear power plant license renewals. For certain types of environmental impacts, the GEIS contains generic findings that apply to all nuclear power plants and are codified in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act - Regulations Implementing Section 102(2)," of 10 CFR Part 51. Pursuant to 10 CFR 51.53(c)(3)(i), a license renewal applicant may incorporate these generic findings in its environmental report. In accordance with 10 CFR 51.53(c)(3)(ii), an environmental report must also include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with the National Environmental Policy Act of 1969 and 10 CFR Part 51, the staff reviewed the plant-specific environmental impacts of license renewal, including whether there was new and significant information not considered in the GEIS. As part of its scoping process, the staff held a public meeting on April 16, 2009, at the Plantation Inn in Crystal River, Florida, to identify plant-specific environmental issues. The staff will prepare a draft, plant-specific supplement to the GEIS, which will document the results of the environmental review and make a preliminary recommendation as to the license renewal action. The staff will hold another public meeting to discuss the draft, plant-specific supplement to the GEIS.

1.3 Principal Review Matters

Part 54 of 10 CFR describes the requirements for the renewal of operating licenses for nuclear power plants. The staff's technical review of the LRA was in accordance with NRC guidance and 10 CFR Part 54 requirements. Section 54.29, "Standards for Issuance of a Renewed License," of 10 CFR sets forth the license renewal standards. This SER describes the results of the staff's safety review.

Pursuant to 10 CFR 54.19(a), the NRC requires a license renewal applicant to submit general information, which the applicant provided in LRA Section 1. The staff reviewed LRA Section 1 and finds that the applicant has submitted the required information.

Pursuant to 10 CFR 54.19(b), the NRC requires that the LRA include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." On this issue, the applicant stated the following in the LRA:

> Indemnity Agreement No. B-54 for CR-3 states in Article VII that the agreement shall terminate at the time of expiration of that license specified in Item 3 of the Attachment to the agreement. Item 3 of the attachment to the Indemnity Agreement, as amended, lists operating license DPR-72. The Company requests that conforming changes be made to the indemnity agreement, and/or the Attachment to the agreement, as required, to specify the extension of the agreement until the expiration date of the renewed CR-3 operating license as sought in this application.

The staff intends to maintain the original license number upon issuance of the renewed license, if approved. Therefore, conforming changes to the indemnity agreement need not be made and the 10 CFR 54.19(b) requirements have been met.

Pursuant to 10 CFR 54.21, "Contents of Application – Technical Information," the NRC requires that the LRA contain: (a) an integrated plant assessment, (b) a description of any CLB changes during the staff's review of the LRA, (c) an evaluation of TLAAs, and (d) an FSAR supplement. LRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a), (b), and (c). LRA Appendix A satisfies the license renewal requirements of 10 CFR 54.21(d).

Pursuant to 10 CFR 54.21(b), the NRC requires that, each year following submission of the LRA and at least 3 months before the scheduled completion of the staff's review, the applicant submit an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the FSAR supplement. By letter dated December 14, 2009, the applicant submitted an LRA update which summarizes the CLB changes that have occurred during the staff's review of the LRA. This submission satisfies 10 CFR 54.21(b) requirements.

Pursuant to 10 CFR 54.22, “Contents of Application – Technical Specifications,” the NRC requires that the LRA include changes or additions to the technical specifications (TSs) that are necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that no changes to the CR-3 TS are required to support the LRA. This statement adequately addresses the 10 CFR 54.22 requirement.

The staff evaluated the technical information required by 10 CFR 54.21 and 10 CFR 54.22 in accordance with NRC regulations and SRP-LR guidance. SER Sections 2, 3, and 4 document the staff’s evaluation of the LRA technical information.

As required by 10 CFR 54.25, “Report of the Advisory Committee on Reactor Safeguards,” the ACRS will issue a report documenting its evaluation of the staff’s LRA review and SER. SER Section 5 is reserved for the ACRS report when it is issued. SER Section 6 documents the findings required by 10 CFR 54.29.

1.4 Interim Staff Guidance

License renewal is a living program. The staff, industry, and other interested stakeholders gain experience and develop lessons learned with each renewed license. The lessons learned address the staff’s performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. Interim staff guidance (ISG) is documented for use by the staff, industry, and other interested stakeholders until incorporated into such license renewal guidance documents as the SRP-LR and GALL Report.

Table 1.4-1 shows the current set of ISGs, as well as the SER sections in which the staff addresses them.

Table 1.4-1 Current Interim Staff Guidance

ISG Issue (Approved ISG Number)	Purpose	SER Section
Nickel-alloy components in the reactor coolant pressure boundary **(LR-ISG-19B)**	Cracking of nickel-alloy components in the reactor pressure boundary. ISG under development. NEI and EPRI-MRP will develop an augmented inspection program for GALL AMP XI.M11-B. This AMP will not be completed until the NRC approves an augmented inspection program for nickel-alloy base metal components and welds as proposed by EPRI-MRP.	**SER Appendix A**
Changes to GALL AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" **(LR-ISG-2007-02)**	The staff proposed changes to GALL AMP XI.E6 to clarify and recommend a one-time inspection, on a representative sample basis, to ensure that either aging of metallic cable connections is not occurring or that an existing preventative maintenance program is effective, such that a periodic inspection is not required. In a letter dated October 18, 2007 (NEI, 2007b), NEI provided comments on the draft LR-ISG.	**SER Section 3.0.3.2.16**
Aging Management of Spent Fuel Pool Neutron-Absorbing Materials other than Boraflex **(LR-ISG-2009-01)**	This LR-ISG recommends an AMP to address the potential loss of material and loss of neutron-absorbing capability of certain neutron-absorbing spent fuel pool components within the scope of license renewal.	**SER Sections 3.0.3.3.1 and 3.3.2.2.6**

1.5 <u>Summary of Open Items</u>

As a result of its review of the LRA, including additional information submitted through November 12, 2010, the staff identified the following open items (OIs). An item is considered open if, in the staff's judgment, it does not meet all applicable regulatory requirements at the time of the issuance of this SER. The staff has assigned a unique identifying number to each OI.

<u>OI-3.0.3.1.9-1</u>: One-Time Inspection Sampling

Due to the uncertainty in determining the most susceptible locations and the potential for aging to occur in other locations, the staff noted that large sample sizes may be required in order to adequately confirm an aging effect is not occurring. The applicant's One-Time Inspection Program did not include specific information regarding how the population of components to be sampled or the sample size will be determined. Therefore, by letter dated November 30, 2010, the staff issued an RAI requesting that the applicant provide specific information regarding how the population of components to be sampled will be determined and the size of the sample of components that will be inspected. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.0.3.1.9-1. See SER Section 3.0.3.1.9.

<u>OI-3.0.3.1.10-1</u>: Buried Piping and Tanks Aging Management

In order to account for recent industry operating experience, the staff sought additional information related to the applicant's Buried Piping and Tanks Inspection Program. The applicant provided additional information on August 9, 2010. However, the staff still required additional information to determine if the applicant's AMP will be adequate to manage aging of buried piping and tanks. Therefore, by letter dated November 8, 2010, the staff issued an RAI, requesting information on the number of excavated direct visual inspections that will be conducted; the condition of backfill; the degraded condition of the cathodic protection system for the condensate system and emergency feedwater system; internal inspection methods beyond ultrasonic examination; the frequency of buried tanks inspections; and the availability of the cathodic protection system. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.0.3.1.10-1. See SER Section 3.0.3.1.10.

<u>OI-3.0.3.1.19-1</u>: Submerged Power Cables

The staff finds the applicant's proposed approach for inspecting manholes containing inaccessible in-scope power cable annually not acceptable because an evaluation or justification for not including manhole inspections based on event-driven occurrences such as flooding or heavy rain has not been addressed. Recently-identified industry operating experience has shown that flooding or heavy rain could subject cables within the scope of the program to submergence. The staff has determined that event-driven inspections, in addition to a 1-year periodic inspection frequency, is a conservative approach and, therefore, should be considered. The staff will address this issue with the applicant, and the resolution of this item has been identified as OI-3.0.3.1.19-1. See SER Section 3.0.3.1.19.

<u>OI-3.0.3.2.10-1</u>: Selective Leaching of Materials Sampling

The staff noted during its review that additional information was required for the "scope of the program" program element. Due to the uncertainty in determining the most susceptible locations and the potential for aging to occur in other locations, the staff noted that large sample sizes may be required in order to adequately confirm an aging effect is not occurring. The applicant's Selective Leaching of Materials Program did not include specific information regarding how the selected set of components to be sampled or the sample size will be determined. Therefore, by letter dated November 30, 2010, the staff issued an RAI requesting that the applicant provide specific information regarding how the population of components to be sampled will be determined and the size of the sample of components that will be inspected. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.0.3.2.10-1. See SER Section 3.0.3.2.10.

<u>OI-3.0.3.2.13-1</u>: Masonry Wall Program Inspection Frequency

The staff noted during its review that the inspection frequency for structures within the scope of the Masonry Wall Program had not been described. Therefore, by letter dated November 30, 2010, the staff issued RAI B.2.29-1 requesting that the applicant explain how the interval for inspections for the Masonry Wall Program will ensure that there is no loss of intended function for the components within the scope of the program. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.0.3.2.13-1. See SER Section 3.0.3.2.13.

OI-3.0.3.2.14-1: Structures Monitoring Program Quantitative Acceptance Criteria

The staff noted during its review that the LRA discussed American Concrete Institute (ACI) 349.3R as a reference for the Structures Monitoring Program, but it did not commit to the quantitative acceptance criteria or clearly identify plant-specific quantitative acceptance criteria for Structures Monitoring Program inspections. Therefore, by letter dated November 30, 2010, the staff issued RAI 2.30-6 requesting that the applicant provide the quantitative acceptance criteria for the Structures Monitoring Program. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.0.3.2.14-1. See SER Section 3.0.3.2.14.

OI-3.3.2.2.4.1-1: Cracking Due to Stress-Corrosion Cracking and Cyclic Loading

LRA Section 3.3.2.2.4.1 addresses stainless steel components in the non-regenerative heat exchanger exposed to treated water greater than 60 °C (140 °F) in the makeup and purification system which are being managed for cracking due to SCC and cyclic loading by the Water Chemistry and the One-Time Inspection programs. The SRP-LR also states that although the existing AMP relies on monitoring and control of primary water chemistry to manage cracking due to SCC, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. It further states that an acceptable verification program includes monitoring of the shell side water temperature and radioactivity and eddy current testing of heat exchanger tubes. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Water Chemistry Program controls water chemistry for prevention or mitigation of cracking and that the One-Time Inspection Program verifies that unacceptable degradation of the applicable components is not occurring. However, the applicant did not specify the nondestructive testing methodology that would be used as an alternative to eddy current testing of the heat exchanger tubes. Therefore, by letter dated November 16, 2010, the staff issued RAI 3.3.2.2.4-1 requesting that the applicant provide additional information on how the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program for the subject components. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.3.2.2.4.1-1. See SER Section 3.3.2.2.4.

OI-3.5-1: Containment Delamination

During the most recent refueling outage, the applicant replaced its once-through steam generators (OTSGs). To facilitate replacement of the OTSGs, a hole was made through the containment. During hydro-demolition of the containment concrete in October 2009, a crack was identified in the concrete near the horizontal tendons, approximately 9 inches from the outer surface of the containment, on all four sides of the temporary opening. Therefore, by letter dated November 8, 2010, the staff requested that the applicant explain how the recent plant-specific operating experience will be incorporated into the ASME Section XI, Subsection IWL and Subsection IWE programs and whether or not a plant-specific program is necessary to manage aging of the containment. Specifically, the applicant was requested to include the containment concrete, prestressing tendons, and the containment liner plate in the discussion, and identify and explain any changes to the LRA based on the recent plant-specific operating experience. Pending receipt and review of the applicant's response, this issue has been identified as OI-3.5-1. See SER Sections 3.0.3.1.13, 3.0.3.1.14, 3.5.2.2.1, and 4.5.2.

OI-4.3.3-1: Environmentally-Assisted Fatigue Analysis

In LRA Table 4.3-3, there are 10 plant-specific locations listed based on the 6 generic components identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear power Plant Components." GALL AMP X.M1 states that the impact of the reactor coolant environment on a sample of critical components should include the locations identified in NUREG/CR-6260 as a minimum, and that additional locations may be needed. The staff is uncertain whether the applicant verified that the plant-specific locations listed in the LRA Table 4.3-3, per NUREG/CR-6260, were bounding for the generic NUREG/CR-6260 components. Therefore, by letter dated November 29, 2010, the staff issued RAI 4.3.3-6 requesting that the applicant confirm the plant-specific locations listed in LRA Table 4.3-3 are bounding for the generic NUREG/CR-6260 components. Also, that the locations selected for the environmentally-assisted fatigue analyses in LRA Table 4.3-3 consists of the most limiting locations for CR-3. Pending receipt and review of the applicant's response, this issue has been identified as OI-4.3.3-1. See SER Section 4.3.3.2.

1.6 Summary of Confirmatory Items

As a result of its review of the LRA, including additional information submitted through November 12, 2010, the staff identified the following confirmatory items (CIs). An item is considered confirmatory if the staff and the applicant have reached a satisfactory resolution but the applicant has not yet formally submitted the resolution. The staff has assigned a unique identifying number to each CI.

CI-3.0.3.1.11-1: Compressed Air Monitoring Program GALL Report Consistency

During the staff's review of the LRA, the staff noted that the proposed aging management of compressed air system components was identified as potentially being in conflict with known industry operating experience and the recommendations of the GALL Report. Therefore, the staff requested additional information on the proposed aging management for these components. By letter dated November 12, 2010, the applicant amended its LRA to include the Compressed Air Monitoring Program to manage compressed air system components. The applicant identified the Compressed Air Monitoring Program as being an existing program consistent with GALL AMP XI.M24, "Compressed Air Monitoring." However, the staff has not had the opportunity to conduct a review of the applicant's claim of consistency for this newly-identified program, and thus, the staff's evaluation of the AMP, operating experience, and FSAR supplement have been identified as CI-3.0.3.1.11-1. See SER Section 3.0.3.1.11.

CI-4.3.4.2-1: Thermal Aging of Cast Austenitic Stainless Steel (CASS)

During the staff's review, the staff was unsure why the assessment of reduction of fracture toughness by thermal aging of CASS was not considered a TLAA by the applicant since the RCP casings and nozzles are made of CASS, which is susceptible to thermal embrittlement. Therefore, the staff held a teleconference with the applicant on November 22, 2010, to discuss the disposition of CASS RCP casings and nozzles. During the teleconference, the applicant stated that it would provide a disposition for the CASS RCP casings and nozzles under 10 CFR 54.21(c)(1)(ii). Pending receipt and review of the applicant's additional information, this issue has been identified as CI-4.3.4.2-1. See SER Section 4.3.4.2.

1.7 Summary of Proposed License Conditions

Following the staff's review of the LRA, including subsequent information and clarifications from the applicant, the staff identified 3 proposed license conditions.

The first license condition requires the applicant to include the FSAR supplement, required by 10 CFR 54.21(d), in the next FSAR update, required by 10 CFR 50.71(e), following the issuance of the renewed licenses.

The second license condition requires future activities described in the FSAR supplement to be completed prior to the period of extended operation.

The third license condition requires that all capsules in the reactor vessel that are removed and tested meet the requirements of American Society for Testing and Materials (ASTM) E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the staff prior to implementation. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the staff, as required by 10 CFR Part 50, Appendix H.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Title 10, Section 54.21, "Contents of Application – Technical Information," of the *Code of Federal Regulations* (10 CFR Part 54.21), requires for each license renewal application (LRA) an integrated plant assessment (IPA) listing those structures and components (SCs) subject to an aging management review (AMR) from all of the systems, structures, and components (SSCs) within the scope of license renewal.

LRA Section 2.1, "Scoping and Screening Methodology," describes the methodology for identifying SSCs at the Crystal River Unit 3 Nuclear Generating Plant (CR-3), within the scope of license renewal, and SCs subject to an AMR. The staff reviewed the Florida Power Corporation (FPC or the applicant) scoping and screening methodology to determine whether it meets the scoping requirements of 10 CFR 54.4(a) and the screening requirements of 10 CFR 54.21.

In developing the scoping and screening methodology for the LRA, the applicant considered the requirements of 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (the Rule); statements of consideration on the Rule; and the guidance of Nuclear Energy Institute (NEI) 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," dated June 2005. The applicant also considered the correspondence between the staff, other applicants, and NEI.

2.1.2 Summary of Technical Information in the Application

LRA Sections 2 and 3 state the technical information required by 10 CFR 54.4 and 54.21(a). LRA Section 2.1 describes the process for identifying SSCs meeting the license renewal scoping criteria of 10 CFR 54.4(a) and the process for identifying SCs subject to an AMR, as required by 10 CFR 54.21(a)(1). The applicant provided the results of the process for identifying such SCs in the following LRA sections:

- Section 2.2, "Plant Level Scoping Results"
- Section 2.3, "Scoping and Screening Results: Mechanical Systems"
- Section 2.4, "Scoping and Screening Results: Structures"
- Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control (I&C) Systems"

LRA Section 3, "Aging Management Review Results," states the applicant's aging management results in the following LRA sections:

- Section 3.1, "Aging Management of Reactor Vessel, Internals, and Reactor Coolant System"
- Section 3.2, "Aging Management of Engineered Safety Features Systems"
- Section 3.3, "Aging Management of Auxiliary Systems"
- Section 3.4, "Aging Management of Steam and Power Conversion Systems"
- Section 3.5, "Aging Management of Containments, Structures, and Component Supports"
- Section 3.6, "Aging Management of Electrical and Instrumentation and Controls"

Section 4, "Time-Limited Aging Analyses," states the applicant's evaluation of time-limited aging analyses (TLAAs).

2.1.3 Scoping and Screening Program Review

The staff evaluated the LRA scoping and screening methodology in accordance with the guidance in Section 2.1, "Scoping and Screening Methodology," of NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005. The following regulations form the basis for the acceptance criteria for the scoping and screening methodology review:

- 10 CFR 54.4(a) as to identification of plant SSCs within the scope of the Rule
- 10 CFR 54.4(b) as to identification of the intended functions of plant systems and structures within the scope of the Rule
- 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2) as to the methods used by the applicant to identify plant SCs subject to an AMR

As part of the review of the applicant's scoping and screening methodology, the staff reviewed the activities described in the following sections of the LRA using the guidance contained in the SRP-LR:

- Section 2.1, to ensure that the applicant described a process for identifying SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)
- Section 2.2, to ensure that the applicant described a process for identifying SCs subject to an AMR in accordance with 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2)

In addition, the staff conducted a scoping and screening methodology audit at CR-3, located in Crystal River, Florida, from June 23–26, 2009. The audit focused on ensuring that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the Rule. The staff reviewed implementation of the project-level guidelines and topical reports describing the applicant's scoping and screening methodology. The staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed the administrative control documentation used by the applicant during the scoping and screening process, the quality practices used by the applicant to develop the LRA, and the training and qualification of the LRA development team.

The staff evaluated the quality attributes of the applicant's aging management program (AMP) activities described in LRA Appendix A, "Final Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs." On a sampling basis, the staff performed a system review of the emergency feedwater (EFW), alternate alternating current (AC) diesel generator, complex chilled water, and the turbine building (TB), including a review of the scoping and screening results reports and supporting design documentation used to develop the reports. The purpose of the staff's review was to ensure that the applicant had appropriately implemented the methodology outlined in the administrative controls and to verify that the results are consistent with the current licensing basis (CLB) documentation.

2.1.3.1 Implementation Procedures and Documentation Sources for Scoping and Screening

The staff reviewed the applicant's scoping and screening implementation procedures as documented in the audit report, dated September 29, 2009, to verify whether the process for identifying SCs subject to an AMR was consistent with the LRA and the SRP-LR. Additionally, the staff reviewed the scope of CLB documentation sources and the applicant's process for appropriate consideration of CLB commitments and for adequate implementation of the procedural guidance during the scoping and screening process.

2.1.3.1.1 Summary of Technical Information in the Application

In LRA Section 2.1, the applicant addressed the following information sources for the license renewal scoping and screening process:

- Final Safety Analysis Report (FSAR)
- design-basis documents
- docketed correspondence
- PassPort Equipment Data Base (PassPort EDB)

2.1.3.1.2 Staff Evaluation

Scoping and Screening Implementation Procedures. The staff reviewed the applicant's scoping and screening methodology implementing procedures, including license renewal guidelines, documents, and reports, as documented in the audit report, to ensure the guidance is consistent with the requirements of the Rule, the SRP-LR, and NEI 95-10. The staff finds the overall process used to implement the 10 CFR Part 54 requirements described in the implementing procedures and AMRs is consistent with the Rule, the SRP-LR, and industry guidance.

The applicant's implementing procedures contain guidance for determining plant SSCs within the scope of the Rule and for determining which SCs within the scope of license renewal are subject to an AMR. During the review of the implementing procedures, the staff focused on the consistency of the detailed procedural guidance with information in the LRA, including the implementation of NRC staff positions documented in the SRP-LR.

After reviewing the LRA and supporting documentation, the staff determined that the scoping and screening methodology instructions are consistent with the methodology description provided in LRA Section 2.1. The applicant's methodology is sufficiently detailed to provide concise guidance on the scoping and screening implementation process to be followed during the LRA activities.

Sources of Current Licensing Basis Information. The staff reviewed the scope and depth of the applicant's CLB review to verify that the methodology is sufficiently comprehensive to identify SSCs within the scope of license renewal, as well as SCs requiring an AMR. Pursuant to 10 CFR 54.3(a), the CLB is the set of U.S. Nuclear Regulatory Commission (NRC) requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design bases that are docketed and in effect. The CLB includes applicable NRC regulations, orders, license conditions, exemptions, technical specifications (TSs), and design-basis information (documented in the most recent FSAR). The CLB also includes licensee commitments remaining in effect that were made in docketed licensing correspondence, such as licensee responses to NRC bulletins, generic letters, and enforcement actions, and licensee commitments documented in NRC safety evaluations or licensee event reports.

During the audit, the staff reviewed pertinent information sources used by the applicant including the FSAR, design basis documents, and license renewal boundary drawings. In addition, the applicant's license renewal process identified additional sources of plant information pertinent to the scoping and screening process, including the PassPort EDB, system descriptions, the 10 CFR 54.4(a)(2) report, 10 CFR 54.4(a)(3) reports, plant drawings, technical reports, and engineering correspondence. The staff confirmed that the applicant's detailed license renewal program guidelines specified the use of the CLB source information in developing scoping evaluations.

The PassPort EDB, FSAR, and design basis documents were the applicant's primary repository for system identification and component safety classification information. During the audit, the staff reviewed the applicant's administrative controls for the PassPort EDB, design basis documents, and other information sources used to verify system information. These controls are described and implementation is governed by plant administrative procedures. Based on a review of the administrative controls and a sample of the system classification information contained in the applicable CR-3 documentation, the staff concludes that the applicant has established adequate measures to control the integrity and reliability of CR-3 system identification and safety classification data and, therefore, the staff concludes that the information sources used by the applicant during the scoping and screening process provided a sufficiently controlled source of system and component data to support scoping and screening evaluations.

During the staff's review of the applicant's CLB evaluation process, the applicant explained the incorporation of updates to the CLB and the process used to ensure those updates are adequately incorporated into the license renewal process. The staff determined that LRA Section 2.1 provided a description of the CLB and related documents used during the scoping and screening process that is consistent with the guidance contained in the SRP-LR.

In addition, the staff reviewed the implementing procedures and results reports used to support identification of SSCs that the applicant relied on to demonstrate compliance with the safety-related criteria, nonsafety-related criteria, and the regulated events criteria pursuant to 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping and screening evaluations. The staff finds these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the plant's CLB.

2.1.3.1.3 Conclusion

Based on its review of LRA Section 2.1, the detailed scoping and screening implementing procedures, and the results from the scoping and screening methodology audit, the staff concludes that the applicant's scoping and screening methodology considers CLB information in a manner consistent with the Rule, the SRP-LR, and NEI 95-10 guidance and, therefore, is acceptable.

2.1.3.2 Quality Controls Applied to LRA Development

2.1.3.2.1 Staff Evaluation

The staff reviewed the quality assurance controls used by the applicant to ensure that scoping and screening methodologies used in the LRA were adequately implemented. The applicant applied the following quality assurance processes during the LRA development:

- The scoping and screening methodology was performed in accordance with corporate procedures.
- 10 CFR Part 50, Appendix B was applied to basis documents.
- NEI 95-10, Revision 6 methodology was applied in implementing the process.
- System level reviews were performed using FSAR/CLB documents along with design basis documents and the PassPort EDB.
- Extensive basis documents were prepared as calculations/evaluations to plant procedures.
- Basis documents were retained in the document control system.
- Written procedures were developed to govern the implementation of the scoping and screening methodology.
- Component level reviews of PassPort EDB data were performed to complement system reviews.
- Lessons learned from prior license renewals were incorporated into the application.
- Previous NRC requests for additional information (RAIs) were also reviewed to ensure that applicable issues were addressed.

The staff reviewed the applicant's written procedures and documentation of assessment activities and determined that the applicant had developed adequate procedures to control the LRA development and assess the results of the activities.

2.1.3.2.2 Conclusion

On the basis of its review of pertinent LRA development guidance, discussion with the applicant's license renewal staff, and a review of the applicant's documentation of the activities performed to assess the quality of the LRA, the staff concludes that the applicant's quality assurance activities meet current regulatory requirements and provide assurance that LRA development activities were performed in accordance with the applicant's license renewal program requirements.

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

The staff reviewed the applicant's training process to ensure the guidelines and methodology for the scoping and screening activities were applied in a consistent and appropriate manner. As outlined in the implementing procedures, the applicant requires training for all personnel participating in the development of the LRA and uses only trained and qualified personnel to prepare the scoping and screening implementing procedures. The training included the following activities:

- All license renewal engineers were qualified to perform calculations and design verifications.
- The majority of the staff had completed multiple applications.
- All license renewal engineers were enrolled in engineering support personnel training.
- The applicant's training process provided both instruction and written guidance documents to the personnel involved with LRA development in order to ensure that the personnel had an understanding of the license renewal procedures, industry guidance, and regulations applicable to the scoping and screening activities and LRA development.
- The applicant developed technical training in scoping and screening methodology to establish the necessary knowledge and understanding of the license renewal process and the terminology used to support the license renewal review. The applicant's management and staff also participated in industry groups and task forces.
- Engineering supervisors had prior experience supplemented with classroom training and mentoring from an NEI task force, working groups, and peers.
- Initial qualifications were completed before the project began and included the review of the license renewal process, license renewal project guidelines, and relevant industry documents such as 10 CFR Part 54 regulations; NEI 95-10; Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses;" the SRP-LR; and NUREG-1801, "Generic Aging Lessons Learned Report," Revision 1 (GALL Report).

The staff reviewed the applicant's written procedures and, on a sampling basis, reviewed completed qualification and training records and completed checklists for some of the applicant's license renewal personnel. The staff determined that the applicant had developed and implemented adequate procedures to control the training of personnel performing LRA activities.

2.1.3.3.2 Conclusion

On the basis of discussions with the applicant's license renewal project personnel responsible for the scoping and screening process and its review of selected documentation in support of the process, the staff concludes that the applicant's personnel are adequately trained to implement the scoping and screening methodology described in the applicant's implementing procedures and the LRA.

2.1.3.4 Scoping and Screening Program Review Conclusion

On the basis of a review of information provided in LRA Section 2.1, a review of the applicant's detailed scoping and screening implementing procedures, discussions with the applicant's license renewal personnel, and the results from the scoping and screening methodology audit, the staff concludes that the applicant's scoping and screening program is consistent with the SRP-LR and the requirements of 10 CFR Part 54 and, therefore, is acceptable.

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

LRA Section 2.1 described the applicant's methodology used to scope SSCs pursuant to the requirements of the 10 CFR 54.4(a) criteria. The LRA states that the scoping process used information contained in the PassPort EDB to identify systems and commodity groups to be evaluated for license renewal. The LRA states that system intended functions were identified using information contained in the FSAR, design basis documents, and docketed correspondence and evaluated against criteria provided in 10 CFR Part 54.4 (a)(1), (2), and (3) to determine whether the system or structure should be considered within the scope of license renewal. The applicant asserts that the scoping process identified SSCs that: (1) are safety-related and perform or support an intended function for responding to a design-basis event (DBE), (2) are nonsafety-related but their failure could prevent accomplishment of a safety-related function, or (3) support a specific requirement for one of the five regulated events applicable to license renewal. LRA Section 2.1.1, "Scoping," states that the scoping methodology used by CR-3 is consistent with the industry guidance contained in NEI 95-10, with exceptions.

2.1.4.1 Application of the Scoping Criteria in 10 CFR 54.4(a)(1)

2.1.4.1.1 Summary of Technical Information in the Application

LRA Section 2.1.1.1, "Safety Related Criteria Pursuant to 10 CFR 54.4(a)(1)," states:

> 10 CFR 54.4(a)(1) pertains to safety-related SSCs and states that SSCs within the scope of License Renewal include safety-related SSCs which are those relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49(b)(1)) to ensure the following functions:
>
> 1. The integrity of the reactor coolant pressure boundary;
>
> 2. The capability to shut down the reactor and maintain it in a safe shutdown condition; or

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

A comparison of the License Renewal scoping criteria for safety-related SSCs in 10 CFR 54.4(a)(1) versus that used to define safety-related components in PassPort EDB finds the only difference applicable to CR-3 pertains to the use of 10 CFR 50.67(b)(2). This section of the Code of Federal Regulations describes the use of alternate source terms (ASTs) in radiological evaluations. CR-3 has adopted the use of ASTs, and the requirements of 10 CFR 50.67(b)(2) are applicable to License Renewal scoping. A review of CLB information for AST shows that the components credited with accident response and mitigation of radiological exposures in an accident are consistent with that of previous 10 CFR 100.11 evaluations, such that no changes to plant design or procedures were needed. It follows that CR-3 components identified in PassPort EDB as safety-related meet the criteria of 10 CFR 54.4(a)(1) and are in the scope of License Renewal unless specific evaluation and justification is provided to exclude them.

2.1.4.1.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a DBE to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary; (2) the ability to shut down the reactor and maintain it in a safe shutdown condition; or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.

With regard to identification of DBEs, SRP-LR Section 2.1.3, “Review Procedures,” states:

> The set of DBEs as defined in the Rule is not limited to Chapter 15 (or equivalent) of the UFSAR. Examples of DBEs that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events, such as a high energy line break. Information regarding DBEs as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission’s regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify SSCs relied upon to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)) to ensure the functions described in 10 CFR 54.4(a)(1).

During the audit, the applicant stated that it evaluated the types of events listed in NEI 95-10 (i.e., anticipated operational occurrences, design-basis accidents (DBAs), external events, and natural phenomena) that were applicable to CR-3. The staff reviewed the applicant’s basis documents which described all design basis conditions in the CR-3 CLB and addressed all events defined by 10 CFR 50.49(b)(1) and 10 CFR 54.4(a)(1). The CR-3 FSAR and basis documents discussed events such as internal and external flooding, tornados, and missiles. The staff concludes that the applicant’s evaluation of DBEs was consistent with the SRP-LR.

The applicant performed scoping of SSCs for the 10 CFR 54.4(a)(1) criteria in accordance with the license renewal implementing procedures which provides guidance for the preparation, review, verification, and approval of the scoping evaluations to ensure the adequacy of the results of the scoping process. The staff reviewed the implementing procedures governing the applicant's evaluation of safety-related SSCs and sampled the applicant's reports of the scoping results to ensure that the applicant applied the methodology in accordance with the implementing procedures. In addition, the staff discussed the methodology and results with the applicant's personnel who were responsible for these evaluations.

The staff reviewed the applicant's evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1) and determined that the CR-3 CLB safety-related definition met the definition of safety-related specified in the Rule. The staff reviewed a sample of the license renewal scoping results for the EFW, alternate AC diesel generator, complex chilled water, and the TB to provide additional assurance that the applicant adequately implemented its scoping methodology with respect to 10 CFR 54.4(a)(1). The staff verified that the applicant developed the scoping results for each of the sampled systems consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results, as well as the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal in accordance with the 10 CFR 54.4(a)(1) criteria.

During the review, the staff determined that additional information would be required to complete its review. The staff issued RAI 2.1-1, dated August 20, 2009, requesting that the applicant address components identified as safety-related in the equipment database which were not included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The request included SSCs located in the TB, that were designated as safety-related in the equipment database but were evaluated and determined to not meet the criteria of 10 CFR 54.4(a)(1), and supports attached to a common wall between the TB and the intermediate building (IB) and located within the TB space.

The applicant responded to RAI 2.1-1 by letter dated September 18, 2009, which stated that the applicant had reviewed the equipment located in the TB and identified as safety-related in the plant equipment database.

The applicant's response discussed equipment in the following categories and the applicable conclusions:

- Equipment designated in the equipment database as safety classification S* which indicates that the equipment is associated with a safety function but does not meet safety-related design criteria.

- Switches, control features, and flow transmitters that are conservatively designated as safety-related in the equipment database, but do not support a safety-related function.

- Control power cables that are conservatively designated as safety-related in the equipment database, but provide power to nonsafety-related valves and are isolated from other safety-related circuits.

- Piping supports that support nonsafety-related pipe attached to safety-related pipe located within the intermediate building. The supports are within the scope of license renewal to provide support of the nonsafety-related piping, attached to safety-related piping, in accordance with 10 CFR 54.4(a)(2).

The staff reviewed the applicant's response to RAI 2.1-1 and determined that the applicant had provided a basis for the determination that the components, located in the TB and designated as safety-related in the equipment database, did not support a safety-related function as defined in 10 CFR 54.4(a)(1). In addition, the applicant had provided the basis that control power cables were isolated such that a failure would not affect other safety-related circuits. RAI 2.1-1 is resolved.

2.1.4.1.3 Conclusion

On the basis of its review of systems (on a sampling basis), discussions with the applicant, review of the applicant's scoping process, and response to an RAI, the staff concludes that the applicant's methodology for identifying systems and structures is consistent with the SRP-LR and 10 CFR 54.4(a)(1) and, therefore, is acceptable.

2.1.4.2 Application of the Scoping Criteria in 10 CFR 54.4(a)(2)

2.1.4.2.1 Summary of Technical Information in the Application

LRA Section 2.1.1, "Scoping," states:

> The CR-3 scoping process employed a multi-faceted approach to ensure that SSCs meeting the criteria of 10 CFR 54.4(a)(1) through (a)(3) have been identified. The process of determining which systems and structures are within the scope of License Renewal involved a review of the CR-3 Final Safety Analysis Report (FSAR) and other documents containing descriptive and functional information. The FSAR contains information such as the design bases, design codes and standards, safety classifications, design evaluations, descriptions, and safety analyses applicable to plant systems and structures. This information was used in conjunction with other Current Licensing Basis (CLB) information and plant documents, such as Design Basis Documents, to determine if a particular system or structure function aligns with the criteria of 10 CFR 54.4(a)(1) through (a)(3). The CR-3 scoping process included an evaluation of the PassPort Equipment Data Base (PassPort EDB or the EDB) to determine its potential for use as a scoping tool for License Renewal.

LRA Section 2.1.1.2 states in relation to nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of the functions identified for safety-related SSCs:

> In general, there are two ways that an SSC could satisfy the criteria of 10 CFR 54.4(a)(2). The first of these would be where a functional dependency exists between nonsafety-related and safety-related equipment. An example of this would be if a nonsafety-related pneumatic supply were required to provide motive force for an operator in a safety-related system in order for that system to fulfill a safety-related function. The other means by which nonsafety-related equipment might prevent satisfactory accomplishment of an intended function would be through adverse spatial interactions, such as flooding, spraying, or direct physical contact with safety-related SSCs. Spatial interactions are further categorized into two types: Direct Physical Interactions and Indirect Physical Interactions.

LRA Section 2.1.1.2 states in relation to nonsafety-related SSCs not directly connected to safety-related SSCs:

> Functional Dependencies - The CLB information was evaluated to identify functional dependencies between nonsafety-related and safety-related equipment. The review resulted in a number of additional components being brought into scope.
>
> Direct Physical Interactions - Direct physical interactions involve nonsafety-related components that are connected to and support safety-related components or the occurrence of inadvertent direct contact of a falling nonsafety-related component or structure, such as, the impact of a falling overhead crane or lifting device, onto a safety-related component or structure. For the purposes of License Renewal scoping, it was considered that piping that is adequately supported will not spontaneously fall due to age related failure. Consistent with this philosophy, it is assumed that piping whose functional integrity is routinely affirmed through proper operation and regular observation by plant personnel, will remain supported so long as its supports do not fail. It follows that direct physical interaction of nonsafety-related piping system components with safety-related SSCs is prevented by piping supports, and the "preventive option" consists of managing aging effects of these supports. The approach for managing aging concerns associated with direct physical interactions between nonsafety-related components and safety-related components will include managing supports for nonsafety-related piping and components (including ducting) in the scope of License Renewal.
>
> Indirect Physical Interactions - Indirect physical interactions between nonsafety-related piping and safety-related components are associated with degradation of the piping itself, resulting in leaking, spraying, or other potentially detrimental consequences to safety-related components. NEI 95-10 provides industry guidance regarding the scoping of nonsafety-related components for potential adverse spatial interaction. Using the preventive approach described in Appendix F to NEI 95-10, a review was performed to identify nonsafety-related piping (including Air/Gas systems) and ducting components located within Class I structures and not already in the scope of License Renewal, and to include those components in License Renewal scope under 10 CFR 54.4(a)(2). The methodology used to accomplish this activity is based on EDB equipment type and location information. This review resulted in bringing into scope of License Renewal any nonsafety-related piping and ducting components located within a Class I structure under the scoping criterion of 10 CFR 54.4(a)(2) unless a specific evaluation was performed that concluded a spatial interaction was not credible. The CR-3 licensing basis includes a review of potential interactions between CR-3 non-Class 1 and Class 1 structures against the requirements of USI [unresolved safety issue] A-46. The review determined that no adverse interactions were possible based on factors such as building design and adequate gaps between structures. The review specifically noted that the Turbine Building was evaluated to assure that there was no impact with adjacent structures under wind or seismic conditions. Also, the evaluation addressed the probability of the Unit 1 & 2 smokestacks impacting Unit 3 safe shutdown equipment and concluded that this was not credible. Consistent with this finding,

the Design Basis Document for Major Class III Structures identifies no collision between Class I and non-Class I structures under wind or seismic conditions.

2.1.4.2.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs whose failure could prevent the satisfactory accomplishment of safety-related functions of SSCs relied on to remain functional during and following a DBE to ensure: (1) the integrity of the reactor coolant pressure boundary; (2) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.

RG 1.188, Revision 1 endorses the use of NEI 95-10, Revision 6. NEI 95-10 discusses the staff's position on 10 CFR 54.4(a)(2) scoping criteria, including: (1) nonsafety-related SSCs typically identified in the CLB; (2) consideration of missiles, cranes, flooding, and high-energy line breaks (HELBs); (3) nonsafety-related SSCs connected to safety-related SSCs; (3) nonsafety-related SSCs in proximity to safety-related SSCs; and (4) mitigative and preventive options related to nonsafety-related and safety-related SSC interactions.

In addition, the staff's position (as discussed in NEI 95-10, Revision 6) is that applicants should not consider hypothetical failures, but rather should base their evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports such as safety operational event reports, and engineering evaluations. The staff reviewed LRA Section 2.1.1.2 in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2) and the applicant's implementing procedures and reports.

<u>Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC</u>. The staff determined that nonsafety-related SSCs required to remain functional to support a safety-related function had been reviewed by the applicant for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in LRA Section 2.1.1.2 and the applicant's 10 CFR 54.4(a)(2) scoping calculation document and scoping procedure. The staff confirmed by sampling specific intended functions in the applicant's FSAR that the applicant had appropriately applied the stated methodology to identify the nonsafety-related systems and structures that function to support a safety-related system whose failure could prevent the performance of a safety-related intended function. The applicant also considered missiles, overhead handling systems, internal and external flooding, and HELBs. Therefore, the staff finds that the applicant implemented an acceptable method for including nonsafety-related systems that perform functions that support safety-related intended functions within the scope of license renewal, as required by 10 CFR 54.4(a)(2).

<u>Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs</u>. The staff confirmed that nonsafety-related SSCs directly connected to safety-related SSCs had been reviewed by the applicant for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in LRA Section 2.1.2.1.2 and the applicant's 10 CFR 54.4(a)(2) scoping calculation and procedure. The applicant had reviewed the safety-related to nonsafety-related interfaces for each mechanical

system in order to identify the nonsafety-related components located between the safety to nonsafety-related interface and license renewal structural boundary.

The applicant had used appropriate license renewal drawings and its piping analysis design basis document for systems to identify the safety to nonsafety-related interfaces. Specifically, the applicant's piping analysis required that all nonsafety-related Seismic III supports past the isolation point or valve for safety-related systems were designed as Seismic I supports up to and including the next anchor point in the piping system. An anchor in this context is defined as a full, six-way restraint. The staff determined that piping analysis was consistent with the guidance in NEI 95-10, Appendix F in its application of 10 CFR 54.4(a)(2) scoping.

The applicant also stated that all nonsafety-related piping (including air/gas systems) and ducting components located inside Seismic Class I structures have been conservatively included within scope unless specific evaluations were performed to justify exclusion. Systems with piping penetrating Seismic Class 1 structures were reviewed to identify instances where seismic boundaries extended outside the structure. This application of 10 CFR 54.4(a)(2) scoping is considered a conservative approach to scoping of the applicant's directly connected nonsafety-related SSCs directly connected to safety-related SSCs.

During the review, the staff determined that additional information would be required to complete its review. RAI 2.1-2 was issued on August 20, 2009. The first request in RAI 2.1-2 (the second and third requests are discussed below in the "Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs" discussion) requested that the applicant provide a discussion on the methodology used to determine the portion of nonsafety-related pipe to be included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), where the nonsafety-related pipe extends beyond the space or structure containing the nonsafety-related/safety-related interface.

The applicant responded to RAI 2.1-2 by letter dated September 18, 2009, which stated the following:

> In those cases where the non-safety related piping extended beyond the structure, this process included the following:
>
> - A review of formal pipe stress analyses and associated piping stress isometrics to determine the extent of non-safety related piping (and associated supports) included in the evaluation.
>
> - For non-safety related piping that did not have a formal piping stress analysis, plant construction isometrics, piping layout drawings, plant modification records, etc. were reviewed to determine the extent of non-safety related piping and supports designated as Seismic III that were designed to the applicable seismic design criteria and stress limitations of Seismic I design criteria.
>
> With the information developed in (a) and (b) above, the structure boundaries were reviewed to ensure that the required non-safety related piping was bounded. If the information in (a) and (b) was not available, the non-safety related piping was extended such that the requirements of NEI 95-10, Appendix F, Section 4, were met [a seismic anchor, equivalent anchor as defined in the CLB, or bounding condition as discussed in NEI 95-10, Appendix F].

The staff reviewed the applicant's response to RAI 2.1-2 and determined that the applicant had provided a basis for determining the portion of nonsafety-related pipe, attached to safety-related pipe, within the scope of license renewal. The staff determined that the applicant had used a formal pipe stress analysis, pipe isometrics, and Seismic III support design documentation to identify the portion of nonsafety-related pipe to be included within the scope of license renewal. If such documentation was not available, the applicant included the portion of nonsafety-related pipe up to and including a seismic anchor, equivalent anchor, or bounding condition. The first request in RAI 2.1-2 is resolved.

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs. The staff confirmed that nonsafety-related SSCs with the potential for spatial interaction with safety-related SSCs had been reviewed by the applicant for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in LRA Section 2.1.1.2 and the applicant's 10 CFR 54.4(a)(2) scoping calculation, as well as the scoping procedure. The applicant had considered physical impacts (pipe whip, jet impingement), harsh environments, flooding, spray, and leakage when evaluating the potential for spatial interactions between nonsafety-related systems and safety-related SSCs. The staff further confirmed that the applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The spaces approach focused on the interaction between nonsafety-related and safety-related SSCs that are located in the same space, which was defined for the purposes of the review as a room or cubicle that is separated from other spaces by substantial objects (such as walls, floors, and ceilings). The space is defined such that any potential interaction between nonsafety-related and safety-related SSCs, including flooding, is limited to the space. The applicant also used a conservative criterion in its review that included nonsafety-related piping (including air/gas systems) and ducting components located within Class I structures and not already within the scope of license renewal. This approach would include many piping systems and components not normally within scope of license renewal, resulting in a conservative inclusion of those systems within Class I structures.

During its review, the staff noted that the applicant had performed an evaluation to not include fluid filled, nonsafety-related SSCs located in specific portions of structures which also contain safety-related SSCs within the scope of license renewal. The applicant's evaluation identified approximately five areas located in the auxiliary building (AB) which contained low or moderate energy, fluid-filled, nonsafety-related SSCs in addition to safety-related pipe or cables and connections which had been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). Therefore, RAI 2.1-2 was issued by letter dated August 20, 2009, requesting (the second request in RAI 2.1-2) that the applicant provide the basis for not including low or moderate energy, fluid-filled, nonsafety-related SSCs located in the same space as safety-related SSCs, within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

The applicant responded to RAI 2.1-2 by letter dated September 18, 2009, which stated the following:

> CR-3 LRA Section 2.1.1.2 discusses the scoping review for spatial interactions between nonsafety related and safety related SSCs, and states: This review resulted in bringing into scope of License Renewal any non-safety related piping and ducting components located within a Class I structure under the scoping criterion of 10 CFR 54.4(a)(2) unless a specific evaluation was performed that concluded a spatial interaction was not credible.

The nature of the evaluations resulting in exclusion of spatial interaction scoping for non-safety related piping and ducting components inside Class I structures fell into one of three categories:

1. Non-safety related components in spaces where there are no (a)(1) components, and the space has adequate drainage facilities and physical isolation to preclude adverse interactions with (a)(1) components in other areas of the structure. The physical isolation features (floors, walls, etc.) and drain system components are included in the scope of License Renewal.

2. Spaces where (a)(1) components exist, but abandoned non-safety related components within the space are evaluated as having no credible spatial interaction.

3. Non-safety related components in spaces where (a)(1) components exist, and the (a)(1) components have been evaluated as not vulnerable to credible failures of non-safety related components in the space as a matter of materials or design considerations, consistent with the guidance of NEI 95-10, Appendix F.

CR-3 has revised its evaluations of exclusion of spatial interaction scoping of non-safety related components to require additional qualifications with regard to abandoned equipment, and discontinue exclusions based on vulnerability considerations altogether. The revised categories for exclusion of non-safety related piping and ducting components inside Class I structures from scope for spatial interactions are as follows:

1. Non-safety related components in spaces where there are no (a)(1) components, and the space has adequate drainage facilities and physical isolation to preclude adverse interactions with (a)(1) components in other areas of the structure. The physical isolation features (floors, walls, etc.) and drain system components are included in the scope of license renewal.

2. Non-safety related components abandoned in place that have been verified as physically and functionally isolated from operational plant systems, depressurized and drained.

The applicant's response further stated:

> As a result of these changes, fluid filled components in spaces housing safety related equipment in the auxiliary building have been included in the license renewal scope and subject to aging management review, as applicable. This includes abandoned components that formerly contained fluids, until such time as they can be verified as drained and depressurized.

The staff reviewed the applicant's response to the second request in RAI 2.1-2 and determined that the applicant had modified its methodology to: (1) include abandoned, nonsafety-related SSCs in the vicinity of safety-related SSCs, but which had not been verified to be drained within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(2) and (2) to not use evaluations in which (a)(1) components have been determined to not be vulnerable to credible failures of nonsafety-related components in the space as a matter of materials or design considerations as a basis for not including nonsafety-related SSCs within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). As a result of the implementation of the modified methodology, the applicant had included additional nonsafety-related SSCs, as discussed in RAI 2.1-2, within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The second request in RAI 2.1-2 is resolved.

During the review, the staff noted that several open penetrations in a wall connecting the TB to the IB and was unable to determine if the applicant had evaluated the potential effect of failure of nonsafety-related SSCs located in the TB on safety-related SSCs located in theIB. Therefore, in RAI 2.1-2 (the third request), the staff requested that the applicant provide a basis for not including, within the scope of license renewal, fluid-filled, nonsafety-related SSCs located in the turbine building which have the potential to interact with safety-related SSCs located in the intermediate building.

The applicant responded to RAI 2.1-2 by letter dated September 18, 2009, which discussed evaluations that the applicant had performed related to water exiting the turbine into the IB. The applicant’s response provided the following conclusion based on the evaluations:

> In conclusion, the scupper openings will not allow flooding of the intermediate building from the Turbine Building due to grating which allows released water in the Turbine Building to drain to the lower level of the Turbine Building. Components located in the Intermediate Building have been evaluated for major Main Feedwater system and Main Steam system line breaks. Therefore, non-safety related components located in the Turbine Building will not affect safety related components located in the Intermediate Building due to scupper openings in the wall separating the two buildings.

The staff reviewed the applicant’s response to the third request in RAI 2.1-2 and determined that the applicant had performed evaluations to determine whether the failure of nonsafety-related SSCs located in the TB could impact safety-related SSCs located in the IB. The staff reviewed the applicant’s discussions of the evaluations and concluded that the applicant had provided the basis for not including additional nonsafety-related SSCs located in the TB within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The third request in RAI 2.1-2 is resolved.

2.1.4.2.3 Conclusion

On the basis of its review of the applicant’s scoping process and on the information provided in the response to RAI 2.1-2, the staff concludes that the applicant’s methodology for identifying and including nonsafety-related SSCs, that could affect the performance of safety-related SSCs, within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4(a)(2) and is consistent with the guidance of NEI 95-10, Appendix F and, therefore, is acceptable.

2.1.4.3 Application of the Scoping Criteria in 10 CFR 54.4(a)(3)

2.1.4.3.1 Summary of Technical Information in the Application

<u>Fire Protection</u>. LRA Section 2.1.1.3.1, subsection “Fire Protection,” describes scoping of systems and structures relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the fire protection criterion. The SSCs at CR-3 that support

compliance with 10 CFR 50.48 are within the scope of license renewal. To determine the SSCs required for fire protection within scope, information in the PassPort EDB and other relevant plant documentation was reviewed.

Environmental Qualification. LRA Section 2.1.1.3.2, subsection "Environmental Qualification (EQ)," describes scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the EQ criterion. Part 50.49(b) of 10 CFR 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. An EQ Master List (EQML) of equipment has been developed in accordance with the requirements of 10 CFR 50.49. This list is maintained within the PassPort EDB and identifies the equipment within the scope of the CR-3 EQ program. No further topical reviews were required for license renewal scoping against EQ requirements, and no components were added to the scope of license renewal for this regulated event beyond those identified based on PassPort EDB information.

Pressurized Thermal Shock. LRA Section 2.1.1.3.5, subsection "Pressurized Thermal Shock (PTS)," describes scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the PTS criterion. Part 50.61 of 10 CFR, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," requires that licensees evaluate the reactor vessel (RV) beltline materials against specific criteria to ensure protection against brittle fracture. CR-3 has documented compliance with 10 CFR 50.61 via several docketed letters provided in response to the issuance of 10 CFR 50.61 and to NRC Generic Letter (GL) 92-01, Revision 1, "Reactor Vessel Structural Integrity, 10 CFR 50.54(f)," and Supplement 1, and in letters addressing the impact on RV materials from neutron fluence changes resulting from power uprate. Based upon the current analysis for PTS, CR-3 does not rely on an RG 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," analysis to satisfy the PTS Rule. Since the analysis relies only on RV beltline materials, there are no SSCs, other than the RV, that are within the scope of license renewal as a result of 10 CFR 50.61. Therefore, the RV is within the scope of license renewal based on compliance with 10 CFR 50.61. Based on the above, a license renewal intended function relative to the criteria of 10 CFR 54.4(a)(3) for postulated PTS was identified for the RV.

Anticipated Transient Without Scram. LRA Section 2.1.1.3.3, subsection "Anticipated Transient Without Scram (ATWS)," describes scoping of the systems and structures relied on in safety analysis or plant evaluations to perform a function in compliance with the ATWS criterion. CR-3 design features related to mitigating a postulated ATWS event are within the scope of license renewal because they are relied on to meet the requirements of 10 CFR 50.62. Part 50.62 of 10 CFR required each pressurized water reactor (PWR) to have equipment from the sensor output to final actuation device, that is diverse from the reactor trip system, to automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip under conditions indicative of an ATWS. Additionally, the PWRs manufactured by Combustion Engineering or Babcock & Wilcox (such as CR-3) must have a diverse scram system from the sensor output to interruption of power to the control rods. This scram system must be designed to perform its function in a reliable manner and be independent from the existing reactor trip system.

Station Blackout. LRA Section 2.1.1.3.4, "Station Blackout (SBO)," describes scoping of systems and structures relied on in safety or plant evaluations to perform a function in compliance with the SBO criterion. CR-3's PassPort EDB quality classifications that have been assigned to components credited with compliance with SBO requirements were used to identify the applicable equipment. To augment PassPort EDB-identified components, additional reviews of the CR-3 Station Blackout Applicability Report and other plant documents and procedures were performed.

2.1.4.3.2 Staff Evaluation

The staff reviewed the applicant's approach to identifying mechanical systems and structures relied on to perform functions meeting the requirements of the fire protection, EQ, PTS, ATWS, and SBO regulations. As part of its review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the approach, and evaluated a sample of the mechanical systems and structures included within the scope of license renewal pursuant to 10 CFR 54.4(a)(3).

The staff confirmed that the applicant's implementing procedures describe the process for identifying systems and structures within the scope of license renewal pursuant to 10 CFR 54.4(a)(3). The procedures state that all mechanical systems and structures that perform functions addressed in 10 CFR 54.4(a)(3) are to be included within the scope of license renewal and that the results are to be documented in the scoping results reports. The staff determined that the results reports reference the information sources used for determining the systems and structures credited for compliance with the events listed in the specified regulations.

<u>Fire Protection</u>. The staff determined that the applicant's implementing procedures indicated that it had included systems and structures within the scope of license renewal required for post-fire safe shutdown, fire detection suppression, and commitments made to Appendix A to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," issued May 1976. The applicant noted that it had considered CLB documents to identify systems and structures within the scope of license renewal. These documents included the 10 CFR 50, Appendix R Fire Study and CR-3 Fire Protection Plan; the CR-3 Fire Protection SER and docketed correspondence; the Fire Hazards Analysis Report; the Topical Design Basis Document for Appendix R, which includes the fire protection program plan as required by 10 CFR 50.48; and the FSAR. The staff reviewed, on a sampling basis, the scoping results in conjunction with the LRA and the CLB information to validate the methodology for including the appropriate systems and structures within the scope of license renewal.

The staff determined that the scoping included systems and structures that perform intended functions to meet the requirements of 10 CFR 50.48. Based on its review of the CLB documents and the sample review, the staff determined that the applicant's scoping methodology was adequate for including SSCs credited in performing fire protection functions within the scope of license renewal.

<u>Environmental Qualification</u>. The staff confirmed that the applicant's implementing procedures required the inclusion of safety-related electrical equipment, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishments of safety functions of the safety-related equipment, and certain post-accident monitoring equipment, as defined in 10 CFR 50.49(b)(1), (b)(2), and (b)(3). The staff determined that the applicant used the EQML to identify SSCs necessary to meet the requirements of 10 CFR 50.49.

The staff reviewed the LRA, implementing procedures, scoping results reports, and the EQML to verify that the applicant identified SSCs within the scope of license renewal that meet EQ requirements. Based on that review, the staff determined that the applicant's scoping methodology is adequate for identifying EQ SSCs within the scope of license renewal.

Pressurized Thermal Shock. The staff determined that the applicant's scoping methodology had required the applicant to review the activities performed to meet 10 CFR 50.61, which resulted in the CR-3 RV to be within the scope of license renewal pursuant to 10 CFR 54.4(a)(3). The staff reviewed the basis document and the implementing procedure. The staff determined that the scoping results included the systems and structures that perform intended functions to meet the requirements of 10 CFR 50.61.

Anticipated Transient Without Scram. The staff determined that the applicant had generated a list of plant systems credited for ATWS mitigation based on review of the plant and vendor drawings, the FSAR, docketed correspondence, modifications, and the plant equipment database. The staff reviewed these documents and the LRA in conjunction with the scoping results to validate the methodology for identifying ATWS systems and structures that are within the scope of license renewal. The staff determined that the scoping results included systems and structures that perform intended functions meeting 10 CFR 50.62 requirements. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs with functions credited for complying with the ATWS regulation.

Station Blackout. The staff determined that the applicant identified those systems and structures associated with coping, and safe shutdown of the plant following an SBO event by reviewing plant-specific SBO calculations, the FSAR, drawings, modifications, the plant equipment database, and plant procedures. The staff reviewed, on a sampling basis, these documents and the LRA in conjunction with the scoping results to validate the applicant's methodology. The staff finds that the scoping results included systems and structures that perform intended functions meeting 10 CFR 50.63 requirements. The staff determined that the applicant's scoping methodology was adequate for identifying SSCs credited in complying with the SBO regulation within the scope of license renewal.

2.1.4.3.3 Conclusion

On the basis of the sample reviews, discussions with the applicant, review of the LRA, and review of the implementing procedures and reports, the staff concludes that the applicant's methodology for identifying systems and structures meets the scoping criteria pursuant to 10 CFR 54.4(a)(3) and, therefore, is acceptable.

2.1.4.4 Plant-Level Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

System and Structure Level Scoping. LRA Section 2.1.1, "Scoping," states:

> The process of determining which systems and structures are within the scope of License Renewal involved a review of the CR-3 Final Safety Analysis Report (FSAR) and other documents containing descriptive and functional information. The FSAR contains information such as the design bases, design codes and standards, safety classifications, design evaluations, descriptions, and safety analyses applicable to plant systems and structures. This information was used

in conjunction with other Current Licensing Basis (CLB) information and plant documents, such as Design Basis Documents, to determine if a particular system or structure function aligns with the criteria of 10 CFR 54.4(a)(1) through (a)(3). The CR-3 scoping process included an evaluation of the PassPort Equipment Data Base (PassPort EDB or the EDB) to determine its potential for use as a scoping tool for License Renewal. The PassPort EDB identifies the items to which the Quality Assurance Program applies. The CR-3 scoping process also utilized discipline-specific reviews to ensure that civil and electrical commodities associated with system intended functions were included in the scope of License Renewal.

The process of determining the intended functions for a system began with the review of [the] FSAR. The FSAR contains information such as the design bases, compliance with codes and standards, safety classifications, design evaluations, descriptions of system operation, descriptions of system interdependencies, and safety analyses. This information was used in conjunction with other information retrieved from sources such as Design Basis Documents, docketed correspondence, and procedures to produce the system/structure intended functions. As an adjunct to this evaluation, a review of the component level intended functions derived from PassPort EDB classifications was used to ensure that all system level intended functions were captured. The PassPort EDB review identified some system intended functions based on pertinent component level parameter definitions. The topical calculations for ATWS, FP, PTS, 10 CFR 54.4(a)(2) Scoping, and SBO also provide input into system intended functions. The License Renewal system level intended functions compiled from the PassPort EDB and topical calculations were used in conjunction with the review of the FSAR, Design Basis Documents, and docketed correspondence to obtain the full set of system intended functions.

The License Renewal scoping process requires system function evaluation boundaries to be identified and defines these boundaries as being those mechanical components required for successful completion of a given License Renewal intended function. These components may be identified by highlighted flow diagrams, descriptive text, or component lists in instances where databases or other plant documents are used to define the boundaries of a given function. License Renewal scoping drawings have been developed to facilitate NRC staff review by depicting mechanical components that support system intended functions and, therefore, are within the scope of License Renewal.

2.1.4.4.2 Staff Evaluation

The staff reviewed the applicant's methodology for performing the scoping of plant systems and components to ensure it was consistent with 10 CFR 54.4. The methodology used to determine the systems and components within the scope of license renewal was documented in implementing procedures and scoping results reports for systems. The scoping process defined the plant in terms of systems and structures. Specifically, the implementing procedures identified the systems and structures that are subject to 10 CFR 54.4 review, described the processes for capturing the results of the review, and were used to determine if the system or structure performed intended functions consistent with the criteria of 10 CFR 54.4(a). The process was completed for all systems and structures to ensure that the entire plant was addressed.

The applicant documented the results of the plant-level scoping process in accordance with the implementing documents. The results were provided in the systems and structures documents and reports which contained information including a description of the structure or system, a listing of functions performed by the system or structure, identification of intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the system or structure intended functions. During the audit, the staff reviewed a sampling of the documents and reports along with the screening results reports for the EFW, alternate AC diesel generator, complex chilled water, and the TB and concluded that the applicant's scoping results contained an appropriate level of detail to document the scoping process.

Insulation. The staff reviewed the applicant's evaluation of plant insulation, including RV mirrored insulation, as documented in the license renewal results report and the bulk commodities AMR. The applicant indicated that insulation is within the scope of license renewal and subject to an AMR based on the intended functions of heat transfer reduction and structural or functional support to nonsafety-related SCs, the failure of which could prevent performance of safety-related functions. Both mirrored and non-mirrored insulation was evaluated. The staff determined the applicant's methods and conclusions on insulation and RV mirrored insulation were acceptable.

Consumables. Consumable items were evaluated. Components subject to periodic replacement, or components found to have an established qualified life (e.g., for EQ purposes), were included within the scope of license renewal, but later screened out as short-lived and did not require an AMR. Consumable parts of a component may be passive, long-lived, and necessary to fulfill an intended function. Screening of consumables was done as part of the component AMR or the item was excluded from an AMR using the NRC screening guidance. Many types of consumables are part of a component such as a valve or a pump and, therefore, were identified during screening. Items potentially treatable as consumables were evaluated consistent with the information presented in NEI 95-10, Revision 6. The staff reviewed the scoping and screening of consumables and determined that the applicant followed the process described in the SRP-LR and appropriately categorized consumables in accordance with the guidance. Additionally, the applicant cited all industry guidelines used as the basis for replacement of any item.

2.1.4.4.3 Conclusion

Based on its review of the LRA, site guidance documents, and a sampling of system scoping results reviewed during the audit, the staff concludes that the applicant's methodology for identifying SSCs within the scope of license renewal, and their intended functions, is consistent with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.5 Mechanical Component Scoping

2.1.4.5.1 Summary of Technical Information in the Application

The PassPort EDB contains component level information. Components having predefined attributes consistent with license renewal scoping criteria were categorically identified as being within the scope of license renewal. The CR-3 PassPort EDB was used by the applicant to identify safety-related components meeting 10 CFR 54.4(a)(1), components having potential spatial interactions consistent with the criteria of 10 CFR 54.4(a)(2), and components credited in regulated events described in 10 CFR 54.4(a)(3). The scoping process for CR-3 used the EDB as a tool to facilitate the component level scoping process. This was considered, as stated by the applicant, a beginning point for the overall scoping effort. The applicant also stated that the scoping process does not rely solely on the EDB to establish scoping boundaries, nor does it exclude items from scope based solely on EDB data. The applicant also reviewed components not included within scope based on consideration of EDB data for scoping criteria, in accordance with 10 CFR 54.4, to ensure a comprehensive result.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Section 2.1.1 and the applicant's mechanical scoping methodology procedure used for the mechanical scoping process. Determination of the mechanical system evaluation boundary(s) requires an understanding of system operations in support of intended functions. This was done by the applicant primarily with the use of its plant equipment database, PassPort EDB. The PassPort EDB was the starting point to determine system designators and intended functions. This list was confirmed using other CR-3 licensing basis documents, procedures, and programs.

The evaluation boundaries for mechanical systems were documented on license renewal boundary drawings that were created by marking mechanical piping and instrumentation diagrams to indicate the components within the scope of license renewal. The staff determined that components within the evaluation boundary were reviewed to determine whether they perform an intended function. Intended functions were established based on whether a particular function of a component was necessary to support the system functions that meet the scoping criteria.

The staff reviewed the implementing documents and the CLB documents associated with mechanical system scoping, and finds that the guidance and CLB documents were acceptable to identify mechanical components and support structures in mechanical systems that are within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project personnel and reviewed documentation pertinent to the scoping process. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure and scoping process is consistent SRP-LR Section 2.1.

On a sampling basis, the staff reviewed the applicant's scoping for the EFW, alternate AC diesel generator, and complex chilled water systems in accordance with the scoping criteria of 10 CFR 54.4. The staff also reviewed the methodology and results with the applicant. The staff verified that the applicant had identified and used pertinent engineering and licensing information in order to determine the mechanical component types required to be within the scope of license renewal. As part of the review process, the staff evaluated each system's intended function, the basis for inclusion of the intended function, and the process used to identify each of the system component types. The staff verified that the applicant had identified and highlighted system piping and instrumentation diagrams (P&IDs) to develop the license renewal boundaries in accordance with regulatory guidance.

2.1.4.5.3 Conclusion

On the basis of its review of the LRA, scoping implementation procedures, and a sampling review of mechanical scoping results, the staff concludes that the applicant's methodology for identifying mechanical SSCs within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.6 Structural Component Scoping

2.1.4.6.1 Summary of Technical Information in the Application

LRA Section 2.1.1, “Scoping,” states:

> The CR-3 Civil/Structural scoping process augmented the system scoping process to ensure all structures within the scope of license renewal were captured. While some structures/structural components are listed within CR-3 systems, PassPort EDB does not provide a distinct listing of CR-3 structures. To address this situation, structures were identified based on a review of the FSAR, DBDs [design-basis documents], Maintenance Rule Database, PassPort EDB, and license renewal topical scoping evaluations.
>
> In scoping of structures, the primary consideration was that any structure that houses or provides physical/functional support for components within the scope of license renewal is itself in the scope of license renewal. Component location information in the PassPort EDB was used to identify structures that house or support license renewal components. Structure intended functions were then associated with the intended functions of the components contained therein. The civil intended functions for each specific structure were logically associated with the intended functions of the components located within. Based on this review, a listing of structures was compiled that encompasses the structural elements required for functional support of systems/components in the scope of license renewal.

2.1.4.6.2 Staff Evaluation

The staff evaluated LRA Section 2.1.1.1 and subsections for scoping methodology and the guidance contained in the implementing procedures and reports to perform the review of the structural scoping process. The staff reviewed the applicant’s approach to identifying structures relied upon to perform the functions described in 10 CFR 54.4(a). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the review, and evaluated the scoping results for a sample of structures (e.g., TB) that were identified within the scope of license renewal. The staff determined that the applicant had identified and developed a list of plant structures and the structure intended functions through a review of the plant equipment database, FSAR, PassPort EDB, drawings, procedures, and walkdowns. Each structure the applicant identified was evaluated against the criteria of 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The staff reviewed selected portions of the plant equipment database, FSAR, PassPort EDB, drawings, procedures, and implementing procedures to verify the adequacy of the methodology. The staff reviewed the applicant’s methodology for identifying structures meeting the scoping criteria as defined in the Rule. The staff also reviewed the scoping methodology implementing procedures and discussed the methodology and results with the applicant. In addition, the staff reviewed, on a sampling basis, the applicant’s scoping reports including information contained in the source documentation, for the TB, to verify that the application of the methodology would provide the results as documented in the LRA.

The staff verified that the applicant had identified and used pertinent engineering and licensing information in order to determine that the TB was required to be included within the scope of license renewal. As part of the review process, the staff evaluated the intended functions identified for the TB and the structural components within, the basis for inclusion of the intended function, and the process used to identify each of the component types.

2.1.4.6.3 Conclusion

On the basis of its review of information in the LRA, scoping implementation procedures, and a sampling review of structural scoping results, the staff concludes that the applicant's methodology for identification of the structural SSCs within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Summary of Technical Information in the Application

The process of determining which systems and structures are within the scope of License Renewal involved a review of the CR-3 FSAR and other documents containing descriptive and functional information. The FSAR contains information such as the design bases, design codes and standards, safety classifications, design evaluations, descriptions, and safety analyses applicable to plant systems and structures. This information was used in conjunction with other CLB information and plant documents, such as Design Basis Documents, to determine if a particular system or structure function aligns with the criteria of 10 CFR 54.4(a)(1) through (a)(3). The CR-3 scoping process included an evaluation of the PassPort EDB to determine its potential for use as a scoping tool for License Renewal. The PassPort EDB identifies the items to which the QA Program applies. The CR-3 scoping process also utilized discipline-specific reviews to ensure that civil and electrical commodities associated with system intended functions were included in the scope of License Renewal.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1 and subsections, and the applicant's implementing procedures, bases documents, and calculations that governed the electrical component scoping methodology to perform the review of the EIC scoping process. The staff reviewed the applicant's approach to identifying EIC SSCs relied upon to perform the functions described in 10 CFR 54.4. The staff also reviewed portions of the documentation used by the applicant to perform the electrical scoping process including the FSAR, scoping calculations, CLB documentation, DBDs, databases and documents, and procedures. As part of this review, the staff discussed the methodology with the applicant, reviewed the implementing procedures developed to support the review, and evaluated the scoping results for a sample of SSCs that were identified within the scope of license renewal.

2.1.4.7.3 Conclusion

On the basis of its review of information contained in the LRA, scoping implementing procedures, scoping bases documents, and a sampling review of electrical scoping results, the staff concludes that the applicant's methodology for the scoping of electrical components within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.8 Conclusion for Scoping Methodology

On the basis of its review of the LRA, scoping implementing procedures, and a sampling review of scoping results, the staff concludes that the applicant's scoping methodology was consistent with the guidance contained in the SRP-LR and identified those SSCs: (1) that are safety-related, (2) whose failure could affect safety-related functions, and (3) that are necessary to demonstrate compliance with NRC regulations for fire protection, EQ, PTS, ATWS, and SBO. The staff concludes that the applicant's methodology is consistent with the requirements of 10 CFR 54.4(a) and, therefore, is acceptable.

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

2.1.5.1.1 Summary of Technical Information in the Application

LRA Section 2.1.2, "Structure and Component Screening," and subsections describe the screening process that identifies the SCs within the scope of license renewal that are subject to an AMR. LRA Section 2.1.2.1 states:

> The License Renewal scoping process identified plant SSCs that are within the scope of License Renewal and their system-level intended functions. Each system identified during scoping as being within the scope of License Renewal is screened to identify passive, long-lived mechanical components that support the system intended functions. The system intended functions, together with component information in PassPort EDB, the 10 CFR 54.4(a)(2) scoping evaluation, the 10 CFR 54.4(a)(3) regulated event scoping evaluations, applicable system drawings, and regulatory guidance, were used to identify the passive components requiring [an] AMR.

2.1.5.1.2 Staff Evaluation

Pursuant to 10 CFR 54.21, each LRA must contain an IPA that identifies SCs within the scope of license renewal that are subject to an AMR. The IPA must identify components that perform an intended function without moving parts or a change in configuration or properties (passive), as well as components that are not subject to periodic replacement based on a qualified life or specified time period (long-lived). In addition, the IPA must include a description and justification of the methodology used to determine the passive and long-lived SCs and a demonstration that the effects of aging on those SCs will be adequately managed so that the intended function(s) will be maintained under all design conditions imposed by the plant-specific CLB for the period of extended operation.

The staff reviewed the methodology used by the applicant to identify the mechanical and structural components and electrical commodity groups within the scope of license renewal that should be subject to an AMR. The applicant implemented a process for determining which SCs were subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). In LRA Section 2.1.2 and subsections, the applicant discussed these screening activities as they related to the component types and commodity groups within the scope of license renewal.

The staff determined that the screening process evaluated the component types and commodity groups, included within the scope of license renewal, to determine which ones were long-lived and passive and, therefore, subject to an AMR. The staff reviewed LRA Section 2.3, “Scoping and Screening Results – Mechanical Systems;” LRA Section 2.4, “Scoping and Screening Results – Structures;” and LRA Section 2.5, “Scoping and Screening Results – Electrical and Instrumentation and Control (I&C) Systems.” These sections of the LRA provided the results of the process used to identify component types and commodity groups subject to an AMR. The staff also reviewed, on a sampling basis, the screening results reports for the EFW, alternate AC diesel generator, complex chilled water, and the TB.

The applicant provided the staff with a detailed discussion of the processes used for each discipline and provided administrative documentation that described the screening methodology. Specific methodology for mechanical, electrical, and structural is discussed below.

2.1.5.1.3 Conclusion

On the basis of its review of the LRA, the implementing procedures, and a sampling of screening results, the staff concludes that the applicant’s screening methodology was consistent with the guidance contained in the SRP-LR and was capable of identifying passive, long-lived components within the scope of license renewal that are subject to an AMR. The staff concludes that the applicant’s process for determining which component types and commodity groups subject to an AMR is consistent with the requirements of 10 CFR 54.21 and, therefore, is acceptable.

2.1.5.2 Mechanical Component Screening

2.1.5.2.1 Summary of Technical Information in the Application

LRA Section 2.1.2, “Structure and Component Screening,” states that the screening process identifies the passive components within the scope of license renewal that are subject to an AMR. The screening process for CR-3 followed the guidance of the Rule and NEI 95-10. The system intended functions, together with component information in the PassPort EDB, the 10 CFR 54.4(a)(2) scoping evaluation, the 10 CFR 54.4(a)(3) regulated event scoping evaluations, applicable system drawings, and regulatory guidance, were used to identify the passive mechanical components requiring an AMR. The guidelines included passive component determinations which are made in accordance with 10 CFR 54.21(a)(1)(i) and the guidance in NEI 95-10 and passive components that are not subject to replacement based on a qualified life or specified time period per 10 CFR 54.21(a)(1)(ii) and are subject to an AMR.

2.1.5.2.2 Staff Evaluation

The staff reviewed the mechanical screening methodology as outlined in the applicant’s implementing procedures and documented in LRA Sections 2.1.2 and 2.1.2.1, as well as the applicant’s license renewal drawings. The staff determined that the mechanical system screening process began with the results from the scoping process and that the applicant reviewed system evaluation boundaries to identify passive and long-lived components. In addition, the staff determined that the applicant’s program intended to identify all passive, long-lived components that perform or support an intended function, within the system evaluation boundaries, and determined those components to be subject to an AMR.

The staff verified that mechanical system evaluation boundaries were established for each system within the scope of license renewal. The staff confirmed that the applicant reviewed the components within the system intended function boundary to determine if the component supported the system intended function and that those components that supported the system intended function were reviewed to determine if the component was passive and long-lived and, therefore, subject to an AMR.

The staff reviewed selected portions of the applicant's licensing basis documents, drawings, and selected scoping and screening results. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed if the mechanical screening methodology outlined in the LRA and license renewal calculations was appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff discussed the screening methodology with the applicant and, on a sampling basis, reviewed the applicant's screening reports for the EFW, alternate AC diesel generator, and complex chilled water systems to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.2.3 Conclusion

On the basis of its review of the LRA, the screening implementing process, selected portions of the FSAR, the PassPort EDB, CLB documentation, drawings, specifications, codes/standards, selected scoping and screening calculations, and the sample system reviews, the staff concludes that the applicant's methodology for identification of mechanical components within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1) and is consistent with the guidance outlined in NEI 95-10 and, therefore, is acceptable.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

LRA Section 2.1.2.2 and subsections state:

> The screening process was initiated by performing a "bulk screening" of civil/structural commodity groups. This was followed by an evaluation performed on each structure identified to be within the scope of license renewal in order to correlate the results of the commodity group screening to the specific components/commodities located in the structure and to assign the proper intended functions to the components/commodities. Civil/structural screening was performed for CR-3 structures on a structure basis; commodities located within the specific structure being screened were addressed as part of the structure. The identification of commodities for a specific structure was performed using PassPort EDB location data, design drawings, general arrangement drawings, penetration drawings, plant modifications, the FSAR, DBDs, system descriptions, and plant walkdowns. The commodity-specific intended functions for each structure were developed based on comparison of the potential intended functions from the generic commodity groups to the specific intended functions of the structure and PassPort EDB component quality classification. The screening process reviewed PassPort EDB equipment types,

design drawings, general arrangement drawings, plant modifications, the FSAR, DBDs, system descriptions, and plant walkdown results within each structure and developed a list of commodities within that structure requiring [an] aging management review. Those SCs that have a component or commodity intended function that supports a structure intended function are subject to an aging management review.

2.1.5.3.2 Staff Evaluation

The staff reviewed the structural screening methodology discussed and documented in LRA Section 2.1.2.2, the implementing procedures, the scoping and screening reports, and the license renewal drawings. The staff reviewed the applicant's methodology for identifying structural components that are subject to an AMR as required in 10 CFR 54.21(a)(1). The staff confirmed that the applicant had reviewed the structures included within the scope of license renewal and identified the passive, long-lived components with component level intended functions and determined those components to be subject to an AMR.

The staff reviewed selected portions of the FSAR, the PassPort EDB, and scoping and screening reports which the applicant had used to perform the structural scoping. The staff also reviewed screening activities, on a sampling basis, and the civil/structural boundary drawing to document the SCs within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process to assess if the screening methodology outlined in the LRA and implementing procedures were appropriately implemented and if the scoping results were consistent with CLB requirements.

During the scoping and screening methodology audit, the staff reviewed the applicant's screening reports for the TB to verify proper implementation of the screening process. Based on these onsite review activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.3.3 Conclusion

On the basis of its review of the LRA, implementing procedures, the FSAR, PassPort EDB, scoping and screening reports, and a sampling of the TB screening results, the staff concludes that the applicant's methodology for identification of structural components within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.4 Electrical Component Screening

2.1.5.4.1 Summary of Technical Information in the Application

LRA Sections 2.1.2, "Structure and Component Screening," and subsections; 2.1.2.3, "Electrical and I&C Systems;" and 2.5, "Scoping and Screening Results – Electrical and Instrumentation and Controls (I&C) Systems," and subsections states that the screening process identifies the in-scope SCs that require an AMR. The LRA states that the screening process was performed by discipline after an initial screening by generic equipment type. The SCs were categorized into commodity groups based on similar design and functional characteristics. The staff noted that the commodity groups include similar components with common characteristics and that component level intended functions of the commodity groups were identified. The screening process evaluation also identified the component level intended functions that were assigned to component types in accordance with NEI 95-10 and the GALL Report. Following the development of a list of electrical commodity groups, the applicant screened out and removed from further consideration those commodity groups classified as active (from NEI 95-10, Appendix B). The applicant organized the remaining components into AMR commodity groups for an AMR.

LRA Section 2.5.4, “Detailed Screening Results,” lists the AMR electrical commodity groups of passive, long-lived components subject to an AMR as follows:

- non-EQ insulated cables and connections; connections include splices, connectors, fuse holders, and terminal blocks
- electrical portions of non-EQ electrical and I&C penetration assemblies
- metal-enclosed bus and connections
- high-voltage insulators
- switchyard bus and connections
- transmission conductors and connections

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant’s methodology used for electrical screening in LRA Sections 2.1.2, “Structure and Component Screening,” and subsections; 2.1.2.3, “Electrical and I&C Systems;” and 2.5, “Scoping and Screening Results – Electrical and Instrumentation and Controls (I&C) Systems,” and subsections. As part of this review, the staff considered the applicant’s implementing procedures, bases documents, plant documents, and drawings. The staff confirmed that the applicant used the screening process described in these documents along with the information contained NEI 95-10, Appendix B; the SRP-LR; the Electric Power Research Institute (EPRI) License Renewal Electrical Handbook; and plant documents and drawings to identify the electrical and I&C components subject to an AMR. The applicant identified commodity groups which meet the passive criteria in accordance with NEI 95-10. The applicant evaluated the identified passive commodities to decide if they were subject to replacement based on a qualified life or specified time period (short-lived), or not subject to replacement (long-lived). The remaining passive, long-lived components were determined to be subject to an AMR. The staff reviewed the screening of selected components to confirm the correct implementation of the methodology. The staff reviewed the LRA, procedures, electrical drawings, and a sample of the results of the screening methodology. The staff determined that the applicant’s methodology was consistent with the description provided in the LRA and the applicant’s implementing procedures.

2.1.5.4.3 Conclusion

On the basis of its review of the LRA, implementing procedures, and a sample of the results of the screening methodology, the staff concludes that the applicant’s methodology for identification of electrical components within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.5 Conclusion for Screening Methodology

On the basis of its review of the LRA, the screening implementing procedures, discussions with the applicant's staff, and a sample review of screening results, the staff concludes that the applicant's screening methodology is consistent with the guidance contained in the SRP-LR and identified those passive, long-lived components within the scope of license renewal that are subject to an AMR. The staff concludes that the applicant's methodology is consistent with the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.6 Summary of Evaluation Findings

On the basis of its review of the information presented in LRA Section 2.1, the supporting information in the scoping and screening implementing procedures and reports, the information presented during the scoping and screening methodology audit, discussions with the applicant sample system reviews, and the applicant's response dated September 18, 2009, to the staff's RAIs, the staff determines that the applicant's scoping methodology is consistent with the requirements of 10 CFR 54.4. The staff also concludes that the applicant's description and justification of its screening methodology are adequate to meet the requirements of 10 CFR 54.21(a)(1). From this review, the staff concludes that the applicant's methodology for identifying systems and structures within the scope of license renewal and SCs requiring an AMR is acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Introduction

In LRA Section 2.1, the applicant described the methodology for identifying SSCs within the scope of license renewal. In LRA Section 2.2, the applicant used the scoping methodology to determine which SSCs must be included within the scope of license renewal. The staff reviewed the plant-level scoping results to determine whether the applicant has properly identified: all systems and structures relied upon to remain functional during and following DBEs, as required by 10 CFR 54.4(a)(1); systems and structures the failure of which could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2); and systems and structures relied on in safety analyses or plant evaluations to perform functions required by regulations referenced in 10 CFR 54.4(a)(3).

2.2.2 Summary of Technical Information in the Application

In LRA Table 2.2-1, the applicant listed plant mechanical systems within the scope of license renewal. In LRA Table 2.2-2, the applicant listed the structures that are within the scope of license renewal. In LRA Table 2.2-3, the applicant listed plant electrical and I&C systems within the scope of license renewal. Based on the DBEs considered in the plant's CLB, other CLB information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

In LRA Section 2.1, the applicant described its methodology for identifying systems and structures within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology and provides its evaluation in SER Section 2.1. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results shown in LRA Tables 2.2-1, 2.2-2, and 2.2-3 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

The staff determined whether the applicant properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The staff reviewed selected systems and structures that the applicant did not identify as within the scope of license renewal to verify whether the systems and structures have any intended functions requiring their inclusion within the scope of license renewal. The staff's review of the applicant's implementation was conducted in accordance with the guidance in SRP-LR Section 2.2, "Plant-Level Scoping Results."

In LRA Section 2.2, the staff identified areas in which additional information was necessary to complete the review of the applicant's plant-level scoping results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.2-01 dated August 14, 2009, the staff noted that the hydrogen monitoring system is mentioned in FSAR Section 9.11.2.1.2 and in LRA Section 2.3.3.61 under the post-accident sampling system (PASS) discussion. In both references, the hydrogen monitoring system is noted to share two sampling points with the PASS. No separate scoping discussion or scoping result regarding the hydrogen monitoring system is presented in the LRA. The applicant was requested to provide additional information explaining why the hydrogen monitoring system was excluded from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the hydrogen monitoring function is not a unique system. The hydrogen monitoring flow paths and hydrogen analyzers discussed in LRA Section 2.3.3.61 are a subsystem of the PASS. Hydrogen analyzers and associated components performing the containment hydrogen monitoring function are depicted on the system scoping drawing and included within the scope of license renewal. In a teleconference with the staff on December 10, 2009, the applicant confirmed that there is no separate hydrogen monitoring system. All intended functions of the hydrogen monitoring system are included in the PASS system description.

Based on its review, the staff finds the applicant's response to RAI 2.2-01 acceptable because the applicant indicated that there is no independent hydrogen monitoring system. Therefore, the staff's concern described in RAI 2.2-01 is resolved.

In RAI 2.2-02 dated August 14, 2009, the staff noted that FSAR Section 10.6 is called "Auxiliary Feedwater;" however, auxiliary feedwater (AFW) is not identified separately in the LRA as a specific system, and components associated with AFW are included within the scope of license renewal. FSAR Section 10.6.1 states that the AFW pump is designed to provide an additional nonsafety grade source of secondary cooling to the once-through steam generators should a loss of all main feedwater and EFW occur. AFW was added in response to the staff's concern on EFW reliability noted in Generic Safety Issue (GSI) 124 and SRP-LR Section 10.4.9. The staff requested that the applicant explain why AFW was not identified as a separate CR-3 system in the LRA and to identify any safety functions provided by the AFW pump.

In its response dated September 11, 2009, the applicant stated that the AFW pump and related components are not an independent system, but are part of the main feedwater system described in LRA Section 2.3.4.10. All AFW components are depicted on LRA drawings as within the scope of license renewal. Except at interfaces with safety-related equipment and structures, the AFW components are nonsafety grade and are not Class 1E powered or electrically connected to the emergency diesel generators (EDGs). As such, the applicant's position is that AFW components are not relied upon during DBEs and are intended for use on an "as available" basis only. The applicant concluded that AFW components perform no safety function and there is no impact on nuclear safety if they fail to operate.

Based on its review, the staff finds the applicant's response to RAI 2.2-02 acceptable because the applicant stated that AFW is not an independent system, but included within the scope of license renewal as part of the main feedwater system under 10 CFR 54.4(a)(2). Furthermore, the applicant stated that AFW performs no safety function credited in any DBE. Therefore, the staff's concern described in RAI 2.2-02 is resolved.

In RAI 2.2-03 dated August 14, 2009, the staff noted that on LRA Figure 2.2-1, "CR-3 Plant Structures," the applicant showed structures in light lines, denoting the structure is not within the scope of license renewal. Among the structures the applicant depicted as not within scope are the RB maintenance building and the health physics (HP) office structures. In FSAR Section 5.1.1.1, the applicant lists Class I SSCs. Among the list is the EFW tank enclosure, which corresponds to the dedicated EFW tank enclosure building on LRA Figure 2.2-1. The RB maintenance building and the HP office are shown next to the Class I structure. However, these structures are shown as not within the scope of license renewal. Due to their proximity, the staff was concerned that these structures could have the potential to interact with the adjacent Class I structure. The applicant was requested to explain the exclusion of the RB maintenance building and HP office structures from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that:

> The RB maintenance support building is a non-safety related sheet metal structure, supported by a structural steel frame on a concrete slab. The HP office is a non-safety related concrete block structure on a concrete slab and is included as part of the RB maintenance support building. The failure of this building will not impact other safety related structures or components. Expansion devices between the RB maintenance support building (including the HP office) and the EFW tank enclosure building were provided to allow for differential movement. Since the RB maintenance support building (including the HP office) is designed as a separate free standing structure and incorporates design details to structurally separate interaction with the EFW tank enclosure building, the RB maintenance support building (including the HP office) was excluded from the scope of license renewal. In addition, there were no components supported by the RB maintenance support building (including the HP office) which were in the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.2-03 acceptable because the applicant stated that expansion devices exist between the RB maintenance support building (including the HP office) and the EFW tank. These are essentially separate structures with design considerations to preclude interaction. Therefore, the staff's concern described in RAI 2.2-03 is resolved.

In RAI 2.2-04 dated August 14, 2009, the staff noted that in FSAR Chapter 1, an outage support building is located adjacent to the borated water storage tank (BWST). However, LRA Figure 2.2-1, "Plant Structures," does not show this structure. The staff was concerned that the outage support building could interact with the adjacent Class I structure. The applicant was requested to explain the exclusion of the outage support building from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the outage support building was removed prior to the submittal of the LRA. Therefore, the outage support building was not discussed in the application.

Based on its review, the staff finds the applicant's response to RAI 2.2-04 acceptable because the outage support building is no longer in place. Therefore, the staff's concern described in RAI 2.2-04 is resolved.

In RAI 2.2-05 dated August 14, 2009, the staff noted that on LRA Figure 2.2-1, "Plant Structures," the applicant showed structures in light lines, denoting that the structure is not within the scope of license renewal. Among the structures that the applicant depicted as not in-scope are the traveling screens. In FSAR Section 5.1.1.1, the applicant listed the Class I SSCs. Among the list is the nuclear steam supply system's (NSSS) intake structure, which corresponds to the circulating water intake structure on LRA Figure 2.2-1. The traveling screens are a part of this Class I structure; however, they are shown as not within the scope of license renewal. Due to their proximity, the staff was concerned that the traveling screens could have the potential to interact with the adjacent Class I structure. In addition, the traveling screens may have a filtering function, which may require them to be within the scope of license renewal. The applicant was requested to explain the exclusion of the traveling screens from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that it does not consider the traveling screens to be safety-related with the following:

> The NRC previously questioned the safety classification of traveling screen CWTS-2 in Section 4.2.1.3 of the letter from S.A. Varga (NRC) to W.S. Wilgus (CR3), Inspection Report No. 50- 302/87-22, dated December 30, 1987. A specific safety classification review for CWTS-2 was provided to the NRC in a letter dated June 30, 1988 (R.C. Widell (CR-3) to S.A Varga (NRC), Subject: Crystal River Unit 3, Docket No. 50-302, Operating License DPR-72, Inspection Report 87-22). It states, "The Traveling Screen CWTS-2 is not classified as safety related because this component is not required to function to support safe shutdown of the plant using the Alternate Nuclear Service Seawater Cooling System (RW)." A review of industry operating experience was performed for the hypothetical failure of a traveling screen. None was identified where the safety related function of a service water system was compromised. Since the traveling screens do not meet any of the scoping criteria in 10 CFR 54.4, they are not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.2-05 acceptable because the applicant's evaluation of the traveling screens found that the screens did not meet the scoping criteria in 10 CFR 54.4, since the screens are not safety-related, do not perform a required filtering function for the safety-related service water system, and have no potential to adversely interface with safety-related components. Therefore, the staff's concern described in RAI 2.2-05 is resolved.

In RAI 2.2-06 dated August 14, 2009, the staff noted that during the CR-3 scoping and screening methodology audit on June 23, 2009, the applicant discussed a portion of the machine shop being within the scope of license renewal to support the Appendix R equipment on the roof. The applicant's reasoning for excluding the remaining support structure of the machine shop from the scope of license renewal is because the failure of the supporting steel would be hypothetical in nature. Additionally, in FSAR Section 2.4.2.4, "Facilities Required for Flood Protection," the applicant described equipment required to remain functional during a postulated hurricane to assure maintenance of the reactor in a safe condition. The applicant described five large doors that have an inflatable-type seal that serves as a backup in the unlikely event of a compression-type seal failure, one of which describes a watertight door into the hot machine shop. FSAR Figure 2.30 shows watertight doors, but not the machine shop. It was not clear to the staff if this component is physically located in the machine shop structure or another structure. The applicant was requested to explain the exclusion of portions of the machine shop and the hot machine shop from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the remainder of the machine shop support structure will be included within the scope of license renewal. The applicant also clarified that the watertight door into the hot machine shop is part of the AB and is included within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.2-06 acceptable because the applicant has expanded the scope of SCs to be included within the scope of license renewal to include the machine shop support structure. Therefore, the staff's concern described in RAI 2.2-06 is resolved.

In RAI 2.2-07 dated August 14, 2009, the staff noted that in LRA Section 2.2, Table 2.2-1, the applicant listed systems within the scope of license renewal. The RB pressure sensing and testing system was listed as not within the scope of license renewal. The applicant does not provide an explicit explanation of what components comprise this system. The applicant did include the leak rate test system within the scope of license renewal, which seems to have the same function as the RB pressure sensing and testing system. The applicant was requested to explain the exclusion of the RB pressure sensing and testing system from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the RB pressure sensing and testing system, as listed in Table 2.2-1, is identified as a separate system. However, the components associated with the RB pressure sensing function are included within the RB spray system and are within the scope of license renewal, as depicted on the LRA system drawing.

Based on its review, the staff finds the applicant's response to RAI 2.2-07 acceptable because the applicant has explained that the components associated with the RB pressure sensing and testing system are included within the RB spray system. The RB spray system is included within the scope of license renewal and is evaluated separately. Therefore, the staff's concern described in RAI 2.2-07 is resolved.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2, the RAI responses, and the FSAR supporting information to determine whether the applicant failed to identify any systems and structures within the scope of license renewal. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified, in accordance with 10 CFR 54.4, the systems and structures within the scope of license renewal.

2.3 Scoping and Screening Results: Mechanical Systems

This section documents the staff's review of the applicant's scoping and screening results for mechanical systems. Specifically, this section discusses:

- reactor vessel, internals, and reactor coolant system
- engineered safety features
- auxiliary systems
- steam and power conversion systems

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs within the scope of license renewal and subject to an AMR. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of mechanical system components that meet the scoping criteria and are subject to an AMR.

The staff's evaluation of the information in the LRA was the same for all mechanical systems and was performed using the evaluation methodology described here, the guidance in SRP-LR Section 2.3, and took into account (where applicable) the system functions described in the FSAR. The objective was to determine whether the applicant identified, in accordance with 10 CFR 54.4, components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components that are within the scope of license renewal were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections and drawings, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the FSAR, for each mechanical system to determine whether the applicant has omitted, from the scope of license renewal, components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all intended functions delineated under 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified.

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs within the scope of license renewal, the staff sought to determine whether the SCs perform their intended functions with moving parts or a change in configuration or properties, or the SCs are subject to replacement after a qualified life or specified time period, as described in

10 CFR 54.21(a)(1). For those meeting either of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

The staff performed an alternate review of selected systems contained in LRA Section 2.3.3, “Auxiliary Systems,” and Section 2.3.4, “Steam and Power Conversion Systems.” The systems selected for an alternate review were determined to have the following characteristics:

- low safety or low risk significance
- little operating experience indicating likely passive failures
- no previous LRA experience indicating a need to perform a detailed review

For the systems selected for alternate review, the staff evaluated the systems’ functions described in the LRA and FSAR to verify that the applicant included, within the scope of license renewal, all component types identified by 10 CFR 54.4(a). The staff reviewed the LRA and FSAR to confirm that the applicant has identified the component types that are typically found within the scope of license renewal. The staff also verified that the applicant has identified the component types subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

Those systems that received an alternate review are as follows:

- chemical addition system
- liquid sampling system
- post-accident liquid sampling system
- domestic water system
- reactor coolant pump lube oil collection system
- leak rate test system
- miscellaneous mechanical & structures system
- roof drains system
- radiation monitoring system
- waste disposal system
- radioactive gas waste disposal system
- radioactive liquid waste disposal system
- reactor coolant and miscellaneous waste evaporator system
- waste gas sampling system
- post-accident containment atmospheric sampling system

- once-through steam generator chemical cleaning system
- condensate and feedwater chemical cleaning system
- electrohydraulic control system
- gland steam system
- gland seal water system
- heater drains system
- heater vents system
- main feedwater turbine lube oil system
- relief valve vent system
- cycle startup system
- turbine generator system

During the initial review, the staff issued RAI 2.3-1, dated April 20, 2009, requesting that the applicant provide the specific intended functions of each system, in accordance with 10 CFR 54.4(a)(1) and (a)(2), in order to determine whether the applicant has properly defined the license renewal scoping boundaries.

The applicant provided its response by letter, dated May 11, 2009, which described the intended functions for each auxiliary system, in accordance with 10 CFR 54.4(a)(1) and (a)(2). The staff used the additional information from the RAI response to complete its review of the auxiliary systems in the LRA.

In RAI 2.3-01 dated October 15, 2009, the staff identified examples of systems which were included within the scope of license renewal under 10 CFR 54.4(a)(3) to operate during postulated fires, but did not contain descriptions of the components in the LRA system discussions, FSAR system descriptions, or LRA drawings. The system examples provided for RAI 2.3-01 are as follows:

- circulating water system
- fuel oil system
- demineralized water system
- instrument air system
- makeup and purification system
- condensate chemical treatment system
- condensate system
- secondary plant system

The staff requested that the applicant provide additional details for the components, that are within the scope of license renewal based on 10 CFR 54.4(a)(3), of the above system examples indicated in the RAI.

In its response dated November 12, 2009, the applicant stated that:

> The mechanical systems identified in Table 2.2-1 of the CR-3 LRA also include electrical and civil components that are credited in licensing evaluations for compliance with 54.4(a)(3) events. Since scoping was done on a system basis, these civil and electrical components are subject to scoping as part of the system they are assigned to in the equipment database (EDB), and their scoping results are reflected in the resulting list of system intended functions presented in the LRA. A review of scoping results for the examples given in this RAI shows that 54.4(a)(3) scoping for each of these systems was coupled to electrical and civil components that do not appear on License Renewal boundary drawings, and that most of these systems have no mechanical components or mechanical intended function associated with 54.4(a)(3) scoping. For example, the Condensate Chemical Treatment, Condensate, Circulating Water, Demineralized Water, Instrument Air, and Makeup & Purification Systems all have fire barrier seals (a civil feature) associated with the 54.4(a)(3) system intended function for Fire Protection. Generally, where 54.4(a)(3) scoping is associated with a mechanical intended function, the function is not unique to the regulated events involved, and is encompassed by the system descriptions provided in Section 2.3 of the CR-3 LRA.

The applicant also provided a table in its response to RAI 2.3-01 to address the 10 CFR 54.4(a)(3) scoping basis for each of the system examples presented in RAI 2.3-01. Each system was also associated with a regulated event to coincide with the 10 CFR 54.4(a)(3) scoping basis.

Based on its review, the staff finds the applicant's response to RAI 2.3-01 acceptable because the applicant clarified its scoping basis for selecting 10 CFR 54.4(a)(3) components and associating these components with a mechanical system. The applicant further identified the 10 CFR 54.4(a)(3) components associated with the system examples. Therefore, the staff's concern described in RAI 2.3-01 is resolved.

In RAI 2.3-02 dated October 15, 2009, the staff noted that the LRA did not specify which version of the FSAR is to be used as a reference. The staff further noted that following the scoping and screening methodology audit in June 2009, it determined that most of the calculations for the LRA were performed using FSAR, Revision 30, while a complete copy of FSAR, Revision 31 was provided during the audit. The applicant was requested to provide revisions to the FSAR that would affect any systems within the scope of license renewal.

In its response dated November 12, 2009, the applicant indicated that FSAR, Revision 31 was submitted to the staff on May 28, 2008. The technical information supporting the LRA was reviewed and updated prior to the submittal of the LRA to the staff on December 16, 2008.

Based on its review, the staff finds the applicant's response to RAI 2.3-02 acceptable because the applicant clarified that FSAR, Revision 31 is in effect for the LRA and all supporting basis calculations were updated as needed to support the technical information used in the LRA.

As the staff continued its review, the following RAIs were created to address the applicant's screening methodology in regards to the staff's review of the mechanical systems scoping boundary drawings and components listed in the AMR tables.

In RAI 2.3-03 dated October 15, 2009, the staff identified several systems with the following continuation issues: (1) continuation from one drawing to another could not be established, (2) drawing numbers and/or locations for continuations were not identified and could not be located where identified, (3) the continuation drawing was not provided, and (4) piping expected to be within scope based on one drawing led to a different conclusion on a connecting drawing.

In RAI 2.3-03, the staff provided a table in order for the applicant to resolve the corresponding continuation issues for the following systems:

- industrial cooling system
- emergency feedwater pump No. 3 diesel air starting system
- decay heat closed-cycle cooling system
- jacket coolant system
- demineralized water system
- instrument air system
- miscellaneous drains system
- nuclear service and decay heat sea water system
- station air system
- station drains system
- waste sampling system
- condenser air removal system
- condensate system
- main feedwater system

In its response dated November 12, 2009, the applicant stated that:

> CR-3 flow diagrams often do not depict, in their entirety, all relief valve discharge piping, instrument air piping to point of use devices, sample piping/tubing and drain piping. These piping components are included in scope in Class I structures. In addition, CR-3 has revised its methodology for spatial interaction scoping to be more inclusive than the original LRA submittal scope as discussed in the response to RAI 2.1-2 in CR-3 to NRC letter, 3F0909-04, "Crystal River Unit 3 - Response to Requests for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC NO. ME0274)," dated September 18, 2009 (ML092650272).

The applicant also provided a table in its response to address the continuation issues identified for each system in RAI 2.3-03. More specifically, in a teleconference with the staff on December 10, 2009, the applicant further clarified the continuation issues for both the station drains system and condensate system.

Based on its review, the staff finds the applicant's response to RAI 2.3-03 acceptable because the applicant revised its scoping methodology to clarify the above continuation issues for the identified systems. The specific details provided in its RAI response allowed the staff to complete its scoping review for SCs. Therefore, the staff's concern described in RAI 2.3-03 is resolved.

In RAI 2.3-04 dated October 15, 2009, the staff identified several components that were found highlighted on LRA drawings as being within the scope of license renewal, but were not found on the associated AMR tables for mechanical systems in the LRA "Scoping and Screening Results–Mechanical Systems" section. In RAI 2.3-04, the staff provided a table of the following systems and requested that the applicant: (1) confirm if the highlighted system components are subject to an AMR and (2) indicate in which component group they are included, or justify their exclusion:

- control complex chilled water system
- Appendix R chilled water system
- industrial cooling system
- circulating water system
- decay heat closed-cycle cooling system
- fuel oil system
- jacket coolant system
- diesel generator lube oil system
- makeup and purification system
- station air system
- secondary services closed-cycle cooling water system
- station drains system
- spent fuel cooling system
- nuclear services closed-cycle cooling system
- condenser air removal system
- auxiliary steam system

In its response dated November 12, 2009, the applicant provided its response to each of the systems that were identified in RAI 2.3-04. Using the table provided by the staff, the applicant specifically clarified whether the highlighted components for each system are subject to an AMR and provided the component group in which they could be located (along with the associated system AMR table) in the LRA. The applicant also provided justification for why certain system components are included within scope, but excluded from an AMR. In a teleconference with the staff on December 10, 2009, the applicant provided additional justification for distinguishing certain components subject to an AMR for the control complex (CC) chilled water and jacket cooling systems.

Based on its review, the staff finds the applicant's response to RAI 2.3-04 acceptable because the additional information provided by the applicant enabled the staff to verify that the highlighted system components were included in an associated component group. The staff confirmed that the applicant's justification for excluding components from an AMR is consistent with the screening methodology described in SER Section 2.3. Therefore, the staff's concern described in RAI 2.3-04 is resolved.

In RAI 2.3-05 dated October 15, 2009, the staff identified several structure types on the LRA drawings that were not included within the scope of license renewal. These structure types were sumps, waste collectors, canals, pits, etc. In RAI 2.3-05, the staff provided a table of the following systems associated with the above structures and requested that the applicant justify the exclusion of the structure types identified above, and any SSCs inside the sumps or structures, from the scope of license renewal:

- floor drains system
- nitrogen supply system
- station drains system
- spent fuel cooling system

In its response dated November 12, 2009, the applicant stated that the structure types listed for the systems in RAI 2.3-05 are located in the RB, AB, IB, diesel generator building, and emergency feedwater pump building (EFPB). These structures are within the scope of license renewal, and the associated sumps, pits, and canals are formed by concrete in each building and are included in the "Concrete - Above Grade" commodity listed in LRA Section 2.4, Tables 2.4.1-1, 2.4.2-1, 2.4.2-9, 2.4.2-10, and 2.4.2-13 for the applicable structures. The liner plate for the incore instrument pit and the fuel transfer canal in the RB are included in the "Steel Components: Fuel Pool Liner" commodity listed in LRA Table 2.4.1-1. Sump liners are included in the "Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Wall Supports, and Other Miscellaneous Structures" commodity listed in LRA Tables 2.4.1-1 and 2.4.2-1.

The applicant also stated that the methodology for the LRA was revised for spatial interaction scoping as follows:

> …to narrowly permit exclusions only in areas where there are not safety related components, that are adequately protected and isolated from other areas of the plant, and are equipped with drain systems which are themselves in the scope of License Renewal. (See the response to RAI 2.1-2 in CR-3 to NRC letter, 3F0909-04, "Crystal River Unit 3 - Response to Requests for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant,

License Renewal Application (TAC NO. ME0274)," dated September 18, 2009 (ML092650272).

Based on the additional analysis, the applicant included all drain system piping and associated components located in the RB, AB, IB, diesel generator building, and EFPB within the scope of license renewal. The applicant also provided a table in its response to indicate the in-scope structure types subject to an AMR for each of the system examples presented in RAI 2.3-05.

Based on its review, the staff finds the applicant's response to RAI 2.3-05 acceptable because the applicant clarified its methodology for identifying the structure types within the scope of license renewal. The applicant further identified the physical locations where the above mentioned structure types can be found and the appropriate LRA tables showing that the structure types are included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3-05 is resolved.

In RAI 2.3-06 dated October 15, 2009, the staff observed that the applicant used a definition for piping, piping components, and piping elements that is based on the GALL Report, Volume 2, Section IX. The CR-3 definition of piping, piping components, and piping elements replaces various combinations of the following: piping, fittings, tubing, flow elements/indicators, filter/demineralizer housings, nozzles, orifices, flex hoses, expansion joints, pump casing and bowl, safe ends, sight glasses, spray head body, strainer housings, thermowells, valve body and bonnet, and closure bolting. However, in the LRA, components such as expansion joints, filters, strainers, and flexible connections are specifically identified in the AMR for one or more mechanical systems, but not identified in the associated tables for other similar mechanical systems.

The staff was also unable to discern a consistent CR-3 methodology for identifying components on the mechanical system AMR tables in the LRA "Scoping and Screening Results – Mechanical Systems" section. Consequently, the staff was unable to verify that all components subject to an AMR are adequately represented in the AMR tables. The staff provided a table with examples of component types from the following systems and requested that the applicant explain its methodology for identifying component types in the systems' AMR tables in the LRA. The staff also requested that the applicant justify the exclusion of the following listed components with a specific intended function from an AMR:

- control complex chilled water system
- industrial cooling system
- emergency feedwater pump No. 3 diesel air starting system
- fuel oil system
- jacket coolant system
- demineralized water system
- emergency diesel generator system
- miscellaneous drains system

- makeup and purification system
- nuclear service and decay heat sea water system

In its response dated November 12, 2009, the applicant referenced the SCs screening process in LRA Section 2.1.2 for describing its methodology for creating commodity groups of like SCs to associate the entire group with an AMR, as suggested in NEI 95-10, Section 4.1. The applicant also stated that the basis for group structures or components can be such characteristics as similar design, materials of construction, aging management practices, and environments. A key clarification that is highlighted by the applicant from Section 2.1.2 is that, "…one of these revisions was the simplification and generalization of terms used to make the component/commodity line items more generic and less prescriptive." Based on the definitions in the GALL Report, Section IX, the applicant explained how the CR-3 application uses the definition of "piping, piping components, and piping elements" to include various combinations of the following component types: piping, fittings, tubing, flow elements/indicators, filter/demineralizer housings, nozzles, orifices, flex hoses, expansion joints, pump casing and bowl, safe ends, sight glasses, spray head body, strainer housings, thermowells, valve body and bonnet, and closure bolting.

The applicant uses the definition of "piping, piping components, and piping elements" to generically address piping system components whose sole component intended function is to provide an "M-1" pressure boundary. Common examples identified by the applicant in the LRA were systems that are only in-scope for potential spatial interaction with safety-related components. The intended function for components in these systems would be to maintain their pressure boundary so as not to leak. In this scenario, the applicant expanded the line item "piping, piping components, and piping elements" to include strainer/flow element housings and heat exchanger shells, as applicable for certain systems. For systems having small miscellaneous tanks, expansion chambers, accumulators, etc., the applicant used the GALL Report variation of the "piping, piping components, piping elements and tanks" definition to reflect the presence of these component types.

Components performing functions other than "M-1" (e.g., straining/filtration, heat transfer, and flow restriction), the above expanded definition would not apply. The applicant further clarified in its response that, "…components and commodities having other component intended functions were broken out into separate line items and associated with the applicable component intended function(s)." The applicant provided separate listings of major system components in the LRA to account for system components consistent with the extent reflected in the GALL Report AMR tables with additional consideration given to providing line items that identify major system pumps, tanks, and heat exchangers. As part of its response to RAI 2.3-06, the applicant provided clarification of this process using the system examples presented in the RAI.

Based on its review, the staff finds the applicant's response to RAI 2.3-06 acceptable because the applicant clarified its methodology for grouping components into commodity groups, allowing the staff to verify that SCs were included within the scope of license renewal and subject to an AMR. The applicant used the table with system examples provided in RAI 2.3-06 to justify how each component type was grouped according to their intended functions, as described above. In a teleconference with the staff on December 10, 2009, the applicant provided additional clarification for components associated with the emergency feedwater pump No. 3 (EFP-3) diesel air starting system. Therefore, the staff's concern described in RAI 2.3-06 is resolved.

2.3.1 Reactor Vessel, Internals, and Reactor Coolant System

LRA Section 2.3.1 identifies the RV, internals, and reactor coolant system (RCS) SCs within the scope of license renewal and subject to an AMR.

The RV, internals, and RCS include mechanical components in the following subsystems:

- reactor coolant system
- control rod drive control system
- incore monitoring system

The applicant described the supporting SCs of the RV, internals, and RCS in the following LRA sections:

- 2.3.1.1, “Reactor Coolant System”
- 2.3.1.2, “Control Rod Drive Control System”
- 2.3.1.3, “Incore Monitoring System”

The staff’s findings on the review of LRA Sections 2.3.1.1 through 2.3.1.3 are in SER Sections 2.3.1.1 through 2.3.1.3, respectively.

2.3.1.1 Reactor Coolant System

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 describes the RV, internals, and RCS. Summaries of each are described below:

Reactor Coolant System. The RCS consists of an RV, two once-through steam generators (OTSGs), an electrically heated pressurizer, four reactor coolant pumps (RCPs), three pressurizer relief valves, and the control/isolation valves and interconnecting piping required for system operation. The system is arranged in two parallel heat transport loops. Each RCS loop contains an OTSG for heat removal and two RCPs that provide the driving head for system flow. Reactor coolant pressure is controlled by the pressurizer, which is designed to maintain system pressure and primary coolant inventory during steady state operation and transient conditions. The system piping configuration and component elevations are designed to facilitate natural circulation cooling when RCS temperature is above 212 °F.

Reactor Vessel and Internals. The RV consists of a cylindrical shell, cylindrical support skirt, spherically dished bottom head, and ring flange to which a removable reactor closure head is bolted. The reactor closure head is a one-piece forged spherically dished head and a matching ring flange. The reactor closure head flange and the RV flange are joined by studs. Two metallic O-rings seal the RV when the reactor closure head is bolted in place. Leak-off taps are provided in the annulus between the two O-rings to dispose of leakage. During refueling outage (RFO) 13, the original reactor vessel closure head (RVCH) was replaced. The replacement RVCH is constructed from a one-piece forging, thereby eliminating the circumferential butt weld and the formed plate dome. Additionally, the replacement RVCH contains control rod drive mechanism (CRDM) nozzles made from Alloy 690, versus the original RVCH which contained CRDM nozzles made of Alloy 600.

The RV internals include the core support assembly, upper plenum assembly, fuel assemblies, control rod assemblies, axial power shaping rod assemblies, surveillance specimens and holder tubes, and incore instrumentation. The RV internals are designed to direct the reactor coolant flow, support the reactor core, and guide the control rods throughout their full stroke.

Once-Through Steam Generators. Two OTSGs supply superheated steam while providing a barrier to prevent fission products and activated corrosion products from entering the steam system. The OTSGs are vertical, straight tube, tube and shell heat exchangers that produce superheated steam at constant pressure over the power range. Reactor coolant flows downward through the tubes and transfers heat to generate steam on the shell side. The high-pressure (i.e., RCS pressure) parts of the steam generators are the hemispherical heads, the tubesheets, and the tubes between the tubesheets. Tube support plates maintain the tubes in a uniform pattern along their length. Each OTSG is supported by a skirt attached to the bottom head. The shell, outside of the tubes, and tubesheets form the boundary of the steam producing section of the OTSG. Within the shell, the tube bundle is surrounded by a cylindrical baffle. Openings in the baffle, at the feedwater inlet nozzle elevation, provide a path for steam to afford contact with feedwater heating. The upper part of the annulus formed by the baffle plate and the shell is the superheat steam outlet zone, while the lower part forms the feedwater inlet heating zone. Vent, drain, instrumentation nozzles, and inspection handholes are provided on the shell side of the steam generators. The reactor coolant side has manway openings in both the top and bottom heads, and a drain nozzle on the bottom head. Venting of the reactor coolant side of each OTSG is accomplished by a vent connection on the reactor coolant inlet pipe. EFW is supplied through an EFW ring located at the top of each OTSG. This arrangement assures natural circulation of the reactor coolant following the unlikely event of the loss of all RCPs.

Pressurizer. The pressurizer is a vertical cylindrical vessel with a bottom surge line penetration connected to the RCS piping at the reactor outlet. The pressurizer contains removable electric heaters in its lower section and a water spray nozzle in its upper section to maintain RCS pressure within desired limits. The pressurizer vessel is protected from thermal effects by a thermal sleeve in the surge line nozzle and spray line nozzle, and by an internal diffuser located above the surge line entrance to the pressurizer.

Reactor Coolant Pumps. The RCPs are single stage, single suction, constant speed, vertical centrifugal pumps. Each RCP employs a shaft sealing system consisting of three mechanical seal assemblies arranged in a removable cartridge and a top vapor barrier standpipe to prevent reactor coolant leakage to the atmosphere. The RCP casing consists of a bottom suction inlet passage which delivers the reactor coolant to the main impeller, a multi-vaned diffuser, and a collecting scroll which directs the reactor coolant out through a horizontal discharge nozzle. A water-lubricated, self-aligning radial hydrostatic bearing is located in the RCP casing just above the main impeller. The RCP casing is welded into the RCS piping. The RCP internals can be removed for inspection or maintenance without removing the RCP casing from the RCS piping. Each RCP has a separate, single speed, top-mounted electric drive motor connected to the pump by a removable shaft coupling. Each RCP stuffing box contains a thermal barrier, recirculation impeller, shaft seal heat exchanger, removable mechanical seal cartridge, and a top vapor barrier standpipe.

During normal operation, the RCS transfers heat from the reactor core to the steam generators where steam is produced to drive the main generator. The RCS consists of an RV, two OTSGs, an electrically heated pressurizer, four RCPs, three pressurizer relief valves, and the control/isolation valves and interconnecting piping required for system operation.

The RCS is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs; (2) nonsafety-related whose failure could prevent satisfactory accomplishment of the safety-related functions; (3) relied on during postulated fires, ATWS, SBO, and PTS events; and (4) part of the EQ program.

LRA Table 2.3.1-1 identifies the components subject to an AMR for the RCS by component type and intended function.

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.1.1.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RCS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Control Rod Drive Control System

2.3.1.2.1 Summary of Technical Information in the Application

The control rod drive (CRD) control system moves the control rods into and out of the reactor core to control reactor power level in response to reactivity effects caused by doppler, xenon, and moderator coefficient changes and in response to operator actions. The CRD system also provides rapid rod insertion in response to protection system commands, thereby shutting down the reactor. Each of the 68 CRDMs is an electro-mechanical device consisting of an electrically-driven rotating nut assembly within a pressure boundary, a four-pole, six-phase stator mounted outside the pressure boundary, and a lead screw.

The CRD system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and

(2) nonsafety-related whose failure could prevent satisfactory accomplishment of the safety-related functions.

LRA Table 2.3.1-2 identifies the components subject to an AMR for the CRD system by component type and intended function.

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2 and the FSAR using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.1.2.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the CRD system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Incore Monitoring System

2.3.1.3.1 Summary of Technical Information in the Application

The incore monitoring system consists of assemblies of self-powered neutron detectors and thermocouples located at 52 positions within the core. In this arrangement, an incore detector assembly consisting of 7 local flux detectors, 1 thermocouple, and 1 background detector is installed in the instrumentation tube of each of the 52 fuel assemblies.

The incore monitoring system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs, (2) relied on during postulated fires, and (3) part of the EQ program.

LRA Table 2.3.1-3 identifies the components subject to an AMR for the incore monitoring system by component type and intended function.

2.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.3 and the FSAR using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.1.3.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the incore monitoring system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

LRA Section 2.3.2 identifies the engineered safety features (ESF) SCs within the scope of license renewal and subject to an AMR.

The applicant described the supporting SCs of the ESF in the following LRA sections:

- 2.3.2.1, “Reactor Building Spray System”
- 2.3.2.2, “Core Flood System”
- 2.3.2.3, “Decay Heat Removal System”
- 2.3.2.4, “Engineered Safeguards Actuation System”
- 2.3.2.5, “Reactor Building Isolation System”

The staff’s findings on its review of LRA Sections 2.3.2.1 through 2.3.2.5 are in SER Sections 2.3.2.1 through 2.3.2.5, respectively.

2.3.2.1 Reactor Building Spray System

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 describes the RB spray system. The RB spray system is a standby system. It includes the caustic addition subsystem designed to add a caustic solution (trisodium phosphate dodecahydrate (TSP-C)) when in the emergency sump recirculation mode.

The RB spray system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs, (2) nonsafety-related whose failure could prevent satisfactory accomplishment of the safety-related functions, (3) relied on during postulated fires, and (4) part of the EQ program.

LRA Table 2.3.2-1 identifies the components subject to an AMR for the RB spray system by component type and intended function.

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1; FSAR Sections 6.2, 14.2.2.1, and 14.2.2.5; and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2.1.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB spray system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.2 Core Flood System

2.3.2.2.1 Summary of Technical Information in the Application

The core flood system is composed of two separate pressurized tanks containing borated water at RB ambient temperature. This passive system automatically discharges its contents directly into the RV at a preset RCS pressure without reliance on any actuation signal or any externally actuated component.

The core flood system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs, (2) nonsafety-related whose failure could prevent satisfactory accomplishment of the safety-related functions, (3) relied on during postulated fires, and (4) part of the EQ program.

LRA Table 2.3.2-2 identifies the components subject to an AMR for the core flood system by component type and intended function.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.2.2.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the core flood system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.3 Decay Heat Removal System

2.3.2.3.1 Summary of Technical Information in the Application

During normal operation, the decay heat removal system provides controlled cooldown of the RCS when coolant temperature is below 280 °F. The system maintains decay heat removal from the core during reactor shutdown and refueling. It also provides decay heat removal and purification/chemistry control during cold shutdown and refueling. During accident conditions, the low-pressure injection (LPI) portion of the decay heat removal system injects borated water into the RV for emergency cooling and reactivity control.

The decay heat removal system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs, (2) nonsafety-related whose failure could prevent satisfactory accomplishment of the safety-related functions, (3) relied on during postulated fires and SBO events, and (4) part of the EQ program.

LRA Table 2.3.2-3 identifies the components subject to an AMR for the decay heat removal system by component type and intended function.

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.3, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.2.3.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the decay heat removal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.4 Engineered Safeguards Actuation System

2.3.2.4.1 Summary of Technical Information in the Application

The engineered safeguards (ES) actuation system monitors process variables and performs protective functions by detecting an accident and providing automatic actuation of the ES systems required to obtain emergency core cooling, RB cooling and isolation, EFW actuation, and RB spray.

The ES actuation system is within the scope of license renewal because it contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs, (2) relied on during postulated fires and SBO events, and (3) part of the EQ program.

There are no mechanical components in the ES actuation system that require an AMR.

2.3.2.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.4 and the FSAR using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.2.4.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the ES actuation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.5 Reactor Building Isolation System

2.3.2.5.1 Summary of Technical Information in the Application

The RB isolation system closes RB fluid penetrations not required for the operation of ES systems in order to prevent leakage of radioactive materials to the environment. Spare/miscellaneous mechanical penetrations and the pressure boundary portions of electrical penetrations are included in the civil/structural screening addressed in LRA Section 2.4.

RB isolation system components have been screened during the screening of each system that contains containment isolation valves. Therefore, the RB isolation system components that require an AMR are included in the screening results for each system described elsewhere in LRA Section 2.3.2.5. No separate listing of RB isolation system components/commodities requiring an AMR is provided.

2.3.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.5 and the FSAR using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The applicant did not provide a detailed review of RB isolation as a stand-alone system. Pressure boundary portions of electrical penetrations and miscellaneous/spare mechanical penetrations are included in the civil/structural screening described in LRA Section 2.4.

The discussion of the RB isolation valves for specific systems is included in the following LRA sections:

- 2.3.3.1, “Air Handling Ventilation and Cooling System”
- 2.3.3.4, “Reactor Building Purge System”
- 2.3.2.1, “Reactor Building Spray System”
- 2.3.3.19, “Chemical Addition System”
- 2.3.3.20, “Liquid Sampling System”
- 2.3.3.21, “Post-Accident Liquid Sampling System”
- 2.3.2.2, “Core Flood System”
- 2.3.4.5, “Once-Through Steam Generator Chemical Cleaning System”
- 2.3.3.24, “Industrial Cooling System”
- 2.3.2.3, “Decay Heat Removal System”
- 2.3.3.32, “Demineralized Water System”
- 2.3.3.36, “Fire Protection System”
- 2.3.4.10, “Main Feedwater System”
- 2.3.3.38, “Instrument Air System”
- 2.3.3.40, “Leak Rate Test System”
- 2.3.4.16, “Main Steam System”
- 2.3.3.42, “Makeup & Purification System”

- 2.3.3.44, “Nitrogen Supply System”
- 2.3.3.46, “Reactor Building Airlock System”
- 2.3.3.50, “Station Air System”
- 2.3.3.53, “Spent Fuel Cooling System”
- 2.3.3.54, “Nuclear Services Closed-Cycle Cooling System”
- 2.3.3.55, “Waste Disposal System”
- 2.3.3.56, “Radioactive Gas Waste Disposal System”
- 2.3.3.57, “Radioactive Liquid Waste Disposal System”
- 2.3.3.61, “Post-Accident Containment Atmospheric Sampling System”

The review of the RB isolation system is included in the review of the above listed systems.

2.3.2.5.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB isolation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

LRA Section 2.3.3 identifies the auxiliary systems SCs within the scope of license renewal and subject to an AMR.

The applicant described the supporting SCs of the auxiliary systems in the following LRA sections:

- 2.3.3.1, “Air Handling Ventilation and Cooling System”
- 2.3.3.2, “Reactor Building Recirculation System”
- 2.3.3.3, “Reactor Building Miscellaneous Ventilation System”
- 2.3.3.4, “Reactor Building Purge System”
- 2.3.3.5, “Auxiliary Building Supply System”
- 2.3.3.6, “Fuel Handling Area Supply System”
- 2.3.3.7, “Decay Heat Closed-Cycle Pump Cooling System”

- 2.3.3.8, “Spent Fuel Coolant Pump Cooling System”
- 2.3.3.9, “Spent Fuel Pit Supply System”
- 2.3.3.10, “Auxiliary Building Exhaust System”
- 2.3.3.11, “Control Complex Ventilation System”
- 2.3.3.12, “Emergency Diesel Generator Air Handling System”
- 2.3.3.13, “Miscellaneous Area HVAC System”
- 2.3.3.14, “Turbine Building Ventilation System”
- 2.3.3.15, “Penetration Cooling System”
- 2.3.3.16, “Emergency Feedwater Initiation and Control Room HVAC System”
- 2.3.3.17, “Appendix R Control Complex Dedicated Cooling Supply System”
- 2.3.3.18, “Emergency Feedwater Pump Building Ventilation System”
- 2.3.3.19, “Chemical Addition System”
- 2.3.3.20, “Liquid Sampling System”
- 2.3.3.21, “Post-Accident Liquid Sampling System”
- 2.3.3.22, “Control Complex Chilled Water System”
- 2.3.3.23, “Appendix R Chilled Water System”
- 2.3.3.24, “Industrial Cooling System”
- 2.3.3.25, “Circulating Water System”
- 2.3.3.26, “Emergency Feedwater Pump No. 3 Diesel Air Starting System”
- 2.3.3.27, “Decay Heat Closed-Cycle Cooling System”
- 2.3.3.28, “Fuel Oil System”
- 2.3.3.29, “Jacket Coolant System”
- 2.3.3.30, “Diesel Generator Lube Oil System”
- 2.3.3.31, “Domestic Water System”
- 2.3.3.32, “Demineralized Water System”
- 2.3.3.33, “Emergency Diesel Generator System”
- 2.3.3.34, “Floor Drains System”

- 2.3.3.35, “Fuel Handling System”
- 2.3.3.36, “Fire Protection System”
- 2.3.3.37, “Hydrogen Supply System”
- 2.3.3.38, “Instrument Air System”
- 2.3.3.39, “Reactor Coolant Pump Lube Oil Collection System”
- 2.3.3.40, “Leak Rate Test System”
- 2.3.3.41, “Miscellaneous Drains System”
- 2.3.3.42, “Makeup & Purification System”
- 2.3.3.43, “Miscellaneous Mechanical & Structures System”
- 2.3.3.44, “Nitrogen Supply System”
- 2.3.3.45, “Penetration Cooling Auxiliary System”
- 2.3.3.46, “Reactor Building Airlock System”
- 2.3.3.47, “Roof Drains System”
- 2.3.3.48, “Radiation Monitoring System”
- 2.3.3.49, “Nuclear Service and Decay Heat Sea Water System”
- 2.3.3.50, “Station Air System”
- 2.3.3.51, “Secondary Services Closed-Cycle Cooling Water System”
- 2.3.3.52, “Station Drains System”
- 2.3.3.53, “Spent Fuel Cooling System”
- 2.3.3.54, “Nuclear Services Closed-Cycle Cooling System”
- 2.3.3.55, “Waste Disposal System”
- 2.3.3.56, “Radioactive Gas Waste Disposal System”
- 2.3.3.57, “Radioactive Liquid Waste Disposal System”
- 2.3.3.58, “Reactor Coolant and Miscellaneous Waste Evaporator System”
- 2.3.3.59, “Waste Gas Sampling System”
- 2.3.3.60, “Waste Sampling System”
- 2.3.3.61, “Post-Accident Containment Atmospheric Sampling System”

The staff's findings on its review of LRA Sections 2.3.3.1 through 2.3.3.61 are in SER Sections 2.3.3.1 through 2.3.3.61, respectively.

2.3.3.1 Air Handling Ventilation and Cooling System

2.3.3.1.1 Summary of Technical Information in the Application

The air handling ventilation and cooling system is not described as an independent system in the FSAR. The system includes many safety-related and nonsafety-related equipment types located in various buildings. System components include fans, air handling units, dampers, air reservoirs/accumulators, the EFP-3 diesel air intake filter, the EFP-3 diesel exhaust pipe flexible expansion joint, the EFP-3 diesel exhaust silencer, and containment isolation valve test connections. The air handling ventilation and cooling system components provide high temperature and fire alarm signals to the fire protection system, form part of the containment pressure boundary, and perform a post-accident monitoring function. The system includes the EFW pump building battery room air handling unit, temperature indicating circuits for the RB and diesel generator room, pressure indication for the EFP-3 air intake filter, air reservoirs for pneumatic dampers, fire dampers in the non-vital battery and charger rooms in the TB, the tank room exhaust system, and components in the control circuits for RB cooling units and containment purge isolation valves.

LRA Section 2.3.3.1 describes the functions of the system. LRA Table 2.3.3-1 identifies the components subject to an AMR for the air handling ventilation and cooling system by component type and intended function.

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.1, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff noted during its review that the air handling ventilation and cooling system description in LRA Section 2.3.3.1 states that air reservoirs/accumulators are included in the system; however, neither LRA Table 2.3.3-1 nor LRA Table 3.3.2-1 include entries for air reservoirs/accumulators. Therefore, by letter dated August 14, 2009, the staff issued RAI 2.3.3.1-1 requesting that the applicant justify excluding the components from the scope of license renewal.

The applicant's response to RAI 2.3.3.1-1, dated September 11, 2009, stated that the air handling ventilation and cooling system air reservoirs/accumulators are included in the component/commodity identified as piping, piping components, piping elements, and tanks in LRA Tables 2.3.3-1 and 3.3.2-1.

Based on its review, the staff finds the applicant's response acceptable because it confirmed that the air handling ventilation and cooling system air reservoirs/accumulators are included in the review as being within the scope of license renewal.

2.3.3.1.3 Conclusion

The staff reviewed the LRA, generic RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the air handling ventilation and cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.2 Reactor Building Recirculation System

2.3.3.2.1 Summary of Technical Information in the Application

During normal operating periods, the RB recirculation system recirculates and filters air through demisters and maintains the average ambient temperature below the improved TS limit (130 °F). During shutdown periods, the RB recirculation system maintains RB temperatures at all locations above a predetermined minimum (60 °F). Under accident conditions, the RB recirculation system functions to limit post-accident ambient pressures and temperatures to design values.

LRA Section 2.3.3.2 describes the functions of the RB recirculation system. LRA Table 2.3.3-2 identifies the components subject to an AMR for the RB recirculation system by component type and intended function.

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.2.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB recirculation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.3 Reactor Building Miscellaneous Ventilation System

2.3.3.3.1 Summary of Technical Information in the Application

The RB miscellaneous ventilation system supplies air to the steam generator compartments, the reactor compartment, and the operating floor during normal operation. The system operates in conjunction with the RB recirculation system (in normal operation mode) to maintain the RB within the required temperature range. Subsystems include the RB steam generator compartment cooling subsystem, RB air supply subsystem, RB cavity cooling subsystem, and the CRD cooling subsystem.

LRA Section 2.3.3.3 describes the functions of the RB miscellaneous ventilation system. LRA Table 2.3.3-3 identifies the components subject to an AMR for the RB miscellaneous ventilation system by component type and intended function.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.3, the staff identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

The LRA states that the RB reactor cavity cooling system heat exchanger housing was within the scope of license renewal and subject to an AMR as a pressure boundary. There was no mention regarding the heat exchanger tubing being within scope. In RAI 2.3.3.3-1, the staff requested clarification on the heat exchanger tubing being within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the heat exchanger tubing is within scope and is included as part of the industrial cooling system discussed in LRA Section 2.3.3.24 and is indicated in LRA Table 2.3.3-24 as isolation piping and components.

Based on its review, the staff finds the applicant’s response acceptable because it confirmed that the heat exchanger tubing is included in the review as being within the scope of license renewal.

2.3.3.3.3 Conclusion

The staff reviewed the LRA, FSAR, RAI 2.3.3.3-1 response, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB miscellaneous ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.4 Reactor Building Purge System

2.3.3.4.1 Summary of Technical Information in the Application

The RB purge system consists of the RB purge exhaust subsystem and the RB purge supply subsystem. The RB purge system operates in MODE 5 (cold shutdown) and MODE 6 (refueling) to provide ventilation to the RB for personnel comfort, reduce building airborne contamination, and filter potentially contaminated particles and gases prior to discharging exhaust air into the atmosphere. The containment isolation valves are controlled manually from the control room and are normally locked closed during operating MODES 1 through 4.

The post-accident safety functions of the system are to maintain RB integrity and provide a hydrogen purge discharge path from the RB. The RB purge system also provides automatic isolation on an RB purge-high radiation signal, if required, to mitigate the consequences of a fuel handling accident involving movement of recently irradiated fuel.

LRA Section 2.3.3.4 describes the functions of the RB purge system. LRA Table 2.3.3-4 identifies the components subject to an AMR for the RB purge system by component type and intended function.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.4.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB purge system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.5 Auxiliary Building Supply System

2.3.3.5.1 Summary of Technical Information in the Application

The AB supply system maintains suitable ambient conditions for personnel and equipment during normal plant operations. The AB supply system stops during emergency conditions to permit the exhaust fans to maintain a negative internal building pressure, thus assuring leakage from the building is controlled.

LRA Section 2.3.3.5 describes the functions of the AB supply system. LRA Table 2.3.3-5 identifies the components subject to an AMR for the AB supply system by component type and intended function.

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.5.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the AB supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.6 Fuel Handling Area Supply System

2.3.3.6.1 Summary of Technical Information in the Application

The fuel handling area supply system is part of a push-pull ventilation system used to capture radiological releases from the spent fuel pool. Air from the fuel handling area supply system sweeps across the spent fuel area and is exhausted at the spent fuel pool end of the AB by the AB exhaust system.

LRA Section 2.3.3.6 describes the functions of the fuel handling area supply system. LRA Table 2.3.3-6 identifies the components subject to an AMR for the fuel handling area supply system by component type and intended function.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.6.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the fuel handling area supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.7 Decay Heat Closed-Cycle Pump Cooling System

2.3.3.7.1 Summary of Technical Information in the Application

The decay heat closed-cycle pump cooling system provides cooling air to the decay heat closed-cycle cooling pump motors. Air accumulators ensure adequate air volume is available to operate required pneumatic fan dampers.

LRA Section 2.3.3.7 describes the functions of the decay heat closed-cycle pump cooling system. LRA Table 2.3.3-7 identifies the components subject to an AMR for the decay heat closed-cycle pump cooling system by component type and intended function.

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.7, the staff identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

The staff noted during its review that the decay heat closed-cycle pump cooling system description in LRA Section 2.3.3.7 states that air accumulators are provided to ensure adequate air volume is available to operate required pneumatic fan dampers; however, neither LRA Table 2.3.3-7 nor LRA Table 3.3.2-7 include entries for air accumulators. Therefore, by letter dated August 14, 2009, the staff issued RAI 2.3.3.7-1 requesting that the applicant justify excluding the components from the scope of license renewal.

The applicant's response to RAI 2.3.3.7-1, dated September 11, 2009, stated that these air accumulators are included as components in the air handling ventilation and cooling system and are included in the component/commodity identified as piping, piping components, piping elements, and tanks in LRA Tables 2.3.3-1 and 3.3.2-1.

Based on its review, the staff finds the applicant's response acceptable because it confirmed that the air accumulators described in LRA Section 2.3.3.7 are included in the review as being within the scope of license renewal.

2.3.3.7.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the decay heat closed-cycle pump cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.8 Spent Fuel Coolant Pump Cooling System

2.3.3.8.1 Summary of Technical Information in the Application

The spent fuel coolant pump cooling system provides cooling air to the spent fuel coolant pump motors. Air accumulators ensure adequate air volume is available to operate required pneumatic fan dampers.

LRA Section 2.3.3.8 describes the functions of the spent fuel coolant pump cooling system. LRA Table 2.3.3-8 identifies the components subject to an AMR for the spent fuel coolant pump cooling system by component type and intended function.

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.8, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff noted during its review that the spent fuel coolant pump cooling system description in LRA Section 2.3.3.8 states that air accumulators are provided to ensure adequate air volume is available to operate required pneumatic fan dampers; however, neither LRA Table 2.3.3-8 nor LRA Table 3.3.2-8 include entries for air accumulators. Therefore, by letter dated August 14, 2009, the staff issued RAI 2.3.3.8-1 requesting that the applicant justify excluding the components from the scope of license renewal.

The applicant's response to RAI 2.3.3.8-1, dated September 11, 2009, stated that these air accumulators are included as components in the air handling ventilation and cooling system and are included in the component/commodity identified as piping, piping components, piping elements, and tanks in LRA Tables 2.3.3-1 and 3.3.2-1.

Based on its review, the staff finds the applicant's response acceptable because it confirmed that air accumulators described in LRA Section 2.3.3.8 are included in the review as being within the scope of license renewal.

2.3.3.8.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the spent fuel coolant pump cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.9 Spent Fuel Pit Supply System

2.3.3.9.1 Summary of Technical Information in the Application

The spent fuel pit supply system provides air flow in the spent fuel pool area to capture gases released by the spent fuel and transport the gases to the AB exhaust system.

LRA Section 2.3.3.9 describes the functions of the spent fuel pit supply system. LRA Table 2.3.3-9 identifies the components subject to an AMR for the spent fuel pit supply system by component type and intended function.

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.9.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the spent fuel pit supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.10 Auxiliary Building Exhaust System

2.3.3.10.1 Summary of Technical Information in the Application

The AB exhaust system provides an operational function to limit the release of radioactivity to the environment. The system operates continuously during normal plant operation to maintain a negative internal AB pressure relative to the outside. During an emergency resulting in high radiation detection in the AB exhaust vent, the AB supply system fans automatically stop, but the AB exhaust system fans continue operation. This further increases the negative internal building pressure, assuring no uncontrolled leakage to the outside.

LRA Section 2.3.3.10 describes the functions of the AB exhaust system. LRA Table 2.3.3-10 identifies the components subject to an AMR for the AB exhaust system by component type and intended function.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.10, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff noted during its review that AB exhaust fans are provided with inlet and outlet pneumatic dampers that have a required function to open to permit airflow when the fan is operating and to close when the fan is stopped to prevent air recirculation to the operating fan. The staff issued RAI 2.3.3.10-1, by letter dated August 14, 2009, requesting that the applicant discuss if there are air accumulators provided to assure required air supply to the damper actuators and if there are, discuss if they are within the scope of license renewal for the function of pressure boundary.

The applicant's response to RAI 2.3.3.10-1, dated September 11, 2009, stated that the AB exhaust system uses instrument air for automatic pneumatic control of system dampers to accomplish proper system function and, therefore, the AB exhaust system does not require air reservoirs or accumulators to ensure the function of the associated system dampers.

Based on its review, the staff finds the applicant's response acceptable because the applicant clarified that the AB exhaust system dampers do not require air reservoirs or accumulators.

2.3.3.10.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the AB exhaust system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.11 Control Complex Ventilation System

2.3.3.11.1 Summary of Technical Information in the Application

The CC ventilation system provides cooling and maintains the vital area temperatures within design values. It also provides protection for the control room operators from radiological limits, smoke, and chemical hazards during emergency conditions and provides ventilation for preventing the buildup of hydrogen in the battery rooms and CC.

LRA Section 2.3.3.11 describes the functions of the CC ventilation system. LRA Table 2.3.3-11 identifies the components subject to an AMR for the CC ventilation system by component type and intended function.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.11, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.11-1 dated August 14, 2009, the staff requested that the applicant clarify between two drawings whether damper AHFD-25 is within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that damper AHFD-25 is included within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-1 acceptable because applicant indicated that the damper is within the scope of license renewal.

In RAI 2.3.3.11-2 dated August 14, 2009, the staff requested that the applicant clarify between two drawings whether component AHU-33 is within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that exhaust fan AHU-33 is included within the scope of license renewal with a pressure boundary function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-2 acceptable because the applicant indicated that the component of concern is within the scope of license renewal.

For the CC ventilation system, the staff could not determine from the drawings or descriptions in the application, or the FSAR, if the pneumatic operated dampers shift to their safety position on the loss of air or on the application of air. If air accumulators are provided to assure the required air supply to the damper actuators, there was no discussion if they are within the scope of license renewal for the function as a pressure boundary. In RAI 2.3.3.11-3 dated August 14, 2009, the staff requested that the applicant clarify if air reservoirs or accumulators are provided and whether or not they are within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that accumulators are provided and that they are within the scope of license renewal. The accumulators are identified in LRA Table 2.3.3-11 as "piping, piping elements, and tanks."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-3 acceptable because the applicant indicated that the accumulators are within the scope of license renewal.

2.3.3.11.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the CC ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.12 Emergency Diesel Generator Air Handling System

2.3.3.12.1 Summary of Technical Information in the Application

The EDG air handling system provides continuous ventilation to dissipate internal heat gains in each EDG room when the diesel is operating. The system also provides combustion air to the EDG.

LRA Section 2.3.3.12 describes the functions of the EDG air handling system. LRA Table 2.3.3-12 identifies the components subject to an AMR for the EDG air handling system by component type and intended function.

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.12, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff could not determine from the LRA, FSAR, or from the license renewal drawings whether the dampers in the EDG air handling system shifted to their required operating position on the loss of air or on the application of air. If the dampers were required to operate on the application of air, air reservoirs or accumulators may be installed to permit operation after a loss of instrument air (IA). In RAI 2.3.3.12-1 dated August 14, 2009, the staff requested that the applicant clarify the operation of the dampers.

In its response dated September 11, 2009, the applicant stated that the safety-related dampers fail to their safety position on a loss of air supply. No accumulators or air reservoirs are required.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-1 acceptable because the applicant clarified the operation of the dampers.

The description for the EDG air handling system indicates end baffles are installed to help assure the exhaust air from below the generator does not recirculate back to the cooling air inlets. These help minimize generator heat rejection to adjacent electrical equipment/components and enhance the capability of the ventilation system to maintain the room temperatures within acceptable limits. There was no discussion if the baffles are within the scope of license renewal. In RAI 2.3.3.12-2 dated August 14, 2009, the staff requested that the applicant clarify if the baffles are within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that in 1997, a concern was identified for recirculation of exhausted cooling air from the EDG to the generator air inlets. In addition, the generator exhausted air was blowing on nearby electrical cabinets. A design was installed which incorporated steel baffle plates and exhaust ductwork to vent the exhausted cooling air above and away from the generator air inlets and the nearby electrical cabinets. The EDGs are within the scope of license renewal. The end baffles are steel plates mounted to the generator housing skid. The generator housing and the baffle plates are integral to the generator and are scoped as part of the generator.

The exhaust ductwork installed as part of the new design and associated with the generator end baffles is included in the EDG air handling system and are within the scope of license renewal. This ductwork is subject to an AMR with the pressure boundary intended function and included in the EDG air handling system component/commodity "ductwork" as shown in LRA Table 2.3.3-12 and LRA Table 3.3.2-12, page 3.3-153.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-2 acceptable because the applicant has included the baffle plates within the scope of license renewal as part of the EDG.

2.3.3.12.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EDG air handling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.13 Miscellaneous Area Heating, Ventilation, and Air Conditioning System

2.3.3.13.1 Summary of Technical Information in the Application

The miscellaneous area heating, ventilation, and air conditioning (HVAC) system subsystems provide the ventilation requirements for the following independent structures:

- intermediate building
- fire pump house
- dedicated emergency feedwater storage tank enclosure
- hot machine shop
- clean machine shop and cold calibration lab
- sodium thiosulfate tank area
- guardhouse
- personnel hatch
- warehouse building

These systems remove internal heat from their respective areas and maintain the building temperature above the minimum design temperature. The fire pump house ventilation system also provides combustion air for the diesel engine-powered fire pumps when they are in operation.

The dedicated EFW storage tank enclosure ventilation system prevents air stagnation and buildup of nitrogen. The hot machine shop air handling subsystem provides heating, ventilation, and cooling to this space and exhausts fumes and polluted air to the AB exhaust system. The clean machine shop and cold calibration lab air handling subsystems provide heating, ventilation, and cooling to the various areas of these spaces. Separate subsystems also provide heating, ventilation, and cooling to spaces in the guardhouse and the warehouse building.

LRA Section 2.3.3.13 describes the functions of the miscellaneous area HVAC system. LRA Table 2.3.3-13 identifies the components subject to an AMR for the miscellaneous area HVAC system by component type and intended function.

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.13.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the miscellaneous area HVAC system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14 Turbine Building Ventilation System

2.3.3.14.1 Summary of Technical Information in the Application

The TB ventilation system subsystems provide the ventilation requirements for the following independent areas:

- turbine building system
- turbine area switchgear system
- non-vital battery room system
- health physics break area system
- clean machine shop and cold calibration lab
- turbine building instrument calibration room
- turbine building sampling room

These systems remove internal heat from their respective areas and maintain the building temperature above the minimum design temperature. The non-vital battery room system also exhausts hydrogen gas.

LRA Section 2.3.3.14 describes the functions of the TB ventilation system. LRA Table 2.3.3-14 identifies the components subject to an AMR for the TB ventilation system by component type and intended function.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.3.14, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

FSAR Section 9.7.2 states that the switchgear room smoke detectors and temperature switches in the return duct close fire dampers. License renewal drawing 302-754-LR, sheet 1 shows the fire damper on the discharge of the switchgear room (AHFD-40) as within scope and the inlet fire damper (no equipment number shown) as not within scope. In RAI 2.3.3.14-1 dated August 14, 2009, the staff requested that the applicant clarify if the inlet fire damper is within the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the fire damper tagged as "Auto Fire Damper (4 Req'd)" should have been highlighted. This fire damper symbol represents four fire dampers. To indicate that the four fire dampers are within scope, the highlighting was placed around the box identifying AHFD-38, AHFD-48, AHFD-49, and AHFD-50. The four fire dampers are within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-1 acceptable because the applicant clarified that the damper of concern is within the scope of license renewal.

2.3.3.14.3 Conclusion

The staff reviewed the LRA, FSAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the TB ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.15 Penetration Cooling System

2.3.3.15.1 Summary of Technical Information in the Application

The penetration cooling system provides cooling for the concrete surrounding hot or potentially hot piping that penetrates containment. The system supplies chilled air flow to the penetration cooling coils so that the adjacent concrete temperature does not exceed 200 °F. Exhaust from the penetration enclosures discharges to the AB exhaust system ductwork.

LRA Section 2.3.3.15 describes the functions of the penetration cooling system. LRA Table 2.3.3-15 identifies the components subject to an AMR for the penetration cooling system by component type and intended function.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.15.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the penetration cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.16 Emergency Feedwater Initiation and Control Room Heating, Ventilation, and Air Conditioning System

2.3.3.16.1 Summary of Technical Information in the Application

The emergency feedwater initiation and control (EFIC) room HVAC system provides cooling and maintains the environmental conditions within the four EFIC equipment rooms at approximately 78 °F dry bulb temperature and 40 percent relative humidity.

LRA Section 2.3.3.16 describes the functions of the EFIC room HVAC system. LRA Table 2.3.3-16 identifies the components subject to an AMR for the EFIC room HVAC system by component type and intended function.

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.16.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EFIC room HVAC system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.17 Appendix R Control Complex Dedicated Cooling Supply System

2.3.3.17.1 Summary of Technical Information in the Application

The Appendix R CC dedicated cooling supply system assists in providing cool air to Appendix R equipment in the CC via dedicated room cooling units. Local area coolers serve the EFIC rooms, 480-volt (V) switchgear rooms A and B, battery charger rooms A and B, remote shutdown panel room, 4,160-V switchgear rooms A and B, inverter rooms A and B, and TB switchgear rooms. The Appendix R CC dedicated cooling supply system supplies the TB switchgear rooms and covers the local area cooler heat exchangers. The Appendix R chilled water system is addressed in SER Section 2.3.3.23. SER Section 2.3.3.1, “Air Handling Ventilation and Cooling System,” addresses the local area cooler fans.

LRA Section 2.3.3.17 describes the functions of the Appendix R CC dedicated cooling supply system. LRA Table 2.3.3-17 identifies the components subject to an AMR for the Appendix R CC dedicated cooling supply system by component type and intended function.

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.17.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the Appendix R CC dedicated cooling supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.18 Emergency Feedwater Pump Building Ventilation System

2.3.3.18.1 Summary of Technical Information in the Application

The EFPB ventilation system: (1) maintains the pump room temperature below maximum design limits when the diesel engine driven EFP is in standby, when the engine is running, and when significant residual heat is being dissipated following engine operation; (2) maintains the battery room atmosphere below explosive limits (i.e., preventing explosive accumulations of hydrogen gas generated by the battery charging operations); and (3) provides a flow path for diesel engine exhaust out of the building while meeting engine backpressure requirements.

LRA Section 2.3.3.18 describes the functions of the EFPB ventilation system. LRA Table 2.3.3-18 identifies the components subject to an AMR for the EFPB ventilation system by component type and intended function.

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.18.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EFPB ventilation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.19 Chemical Addition System

2.3.3.19.1 Summary of Technical Information in the Application

The chemical addition (CA) system provides for the storage, mixing, and distribution of the required quantities of boric acid, sodium hydroxide, lithium hydroxide (LiOH), and hydrazine. The CA system is designed to add boric acid to the RCS for reactivity control, LiOH for pH control, hydrazine for oxygen control, and hydrogen peroxide during system crud reducing evolutions performed at shutdown.

The CA system contains components that: (1) are safety-related, form part of the containment pressure boundary, and are relied upon to remain functional during and following DBEs; (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function; and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.19 describes the functions of the CA system. LRA Table 2.3.3-19 identifies the components subject to an AMR for the CA system by component type and intended function.

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.19.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the CA system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.20 Liquid Sampling System

2.3.3.20.1 Summary of Technical Information in the Application

The system includes containment isolation valves in the liquid sampling system piping that penetrate the RB. The liquid sampling system contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.20 describes the functions of the liquid sampling system. LRA Table 2.3.3-20 identifies the components subject to an AMR for the liquid sampling system by component type and intended function.

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.20.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the liquid sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.21 Post-Accident Liquid Sampling System

2.3.3.21.1 Summary of Technical Information in the Application

The post-accident liquid sampling system is designed to obtain grab samples of reactor liquid at various sample locations for offsite analysis. The post-accident liquid sampling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.21 describes the post-accident liquid sampling system. LRA Table 2.3.3-21 identifies the components subject to an AMR for the post-accident liquid sampling system by component type and intended function.

2.3.3.21.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.21, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.21.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the post-accident liquid sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.22 Control Complex Chilled Water System

2.3.3.22.1 Summary of Technical Information in the Application

The CC chilled water system provides cooling water to the CC ventilation system cooling coils, RB penetration HVAC cooling coils, EFIC room HVAC cooling coils, and the post-accident liquid sampling system interface sample cooler to cool post-accident liquid sampling system sample water. The heat load from the CC chilled water system is removed by the nuclear services closed-cycle cooling system. The CC chilled water system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.22 describes the CC chilled water system. LRA Table 2.3.3-22 identifies the components subject to an AMR for the CC chilled water system by component type and intended function.

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the CC chilled water system in RAI 2.3-04 and RAI 2.3-06, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-04 and RAI 2.3-06 can be found in SER Section 2.3.

In RAI 2.3.3.22-01 dated October 15, 2009, the staff noted that CC chiller lube oil pumps and oil cooler tubes were within the scope of license renewal, based on 10 CFR 54.4(a)(1). However, system lube oil components are not shown on any license renewal scoping drawings, and no discussion of the system lube oil components is provided in the LRA. The applicant was requested to provide supplemental information to allow the staff to verify that all system lube oil components are included within the scope of license renewal.

In its response dated November 12, 2009, the applicant provided a detailed description of the CC chiller lube oil components. The applicant provided additional details on which components are subject to an AMR, as listed in LRA Table 2.3.3-22.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.22-01 acceptable because the applicant provided the necessary additional details on the CC chiller lube oil components to allow the staff to validate which components have been included within scope and are subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.22-01 is resolved.

2.3.3.22.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the CC chilled water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.23 Appendix R Chilled Water System

2.3.3.23.1 Summary of Technical Information in the Application

The Appendix R chilled water system has the capability to supply cooling water to the TB switchgear room air handling unit cooling coils, EFIC room HVAC cooling coils, and miscellaneous CC Appendix R HVAC loads. During normal plant operation, the system provides chilled water to the TB switchgear room cooling coils, and the equipment in the CC is isolated. The Appendix R chilled water system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.3.23 describes the Appendix R chilled water system. LRA Table 2.3.3-23 identifies the components subject to an AMR for the Appendix R chilled water system by component type and intended function.

2.3.3.23.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.23, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the Appendix R chilled water system in RAI 2.3-04, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.23.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the Appendix R chilled water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.24 Industrial Cooling System

2.3.3.24.1 Summary of Technical Information in the Application

The industrial cooling system provides cooling or heating water to the RB cavity cooling system. The system functions in conjunction with the RB air handling systems to maintain an average RB air temperature less than the maximum limit during all phases of normal plant operation. The industrial cooling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.24 describes the industrial cooling system. LRA Table 2.3.3-24 identifies the components subject to an AMR for the industrial cooling system by component type and intended function.

2.3.3.24.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.24, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the industrial cooling system in RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06 can all be found in SER Section 2.3.

2.3.3.24.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the industrial cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.25 Circulating Water System

2.3.3.25.1 Summary of Technical Information in the Application

The circulating water system provides seawater as a cooling medium to the main condenser and to the secondary services closed-cycle cooling water system heat exchangers. The system interfaces with the intake canal, which is the source of water for the system; the nuclear service and decay heat sea water system, which shares the circulating water intake structure; and the screen wash water system, which provides filtration and cleaning of the intake water. The circulating water system function is credited for mitigating a postulated steam generator tube rupture (SGTR) event. The circulating water system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.3.25 describes the circulating water system. LRA Table 2.3.3-25 identifies the components subject to an AMR for the circulating water system by component type and intended function.

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the circulating water system in RAI 2.3-01 and RAI 2.3-04, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-01 and RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.25.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the circulating water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.26 Emergency Feedwater Pump No. 3 Diesel Air Starting System

2.3.3.26.1 Summary of Technical Information in the Application

The EFP-3 diesel air starting system maintains and delivers high-pressure air required to start the diesel-driven EFP-3 diesel engine. The EFP-3 diesel air starting system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support SBO.

LRA Section 2.3.3.26 describes the EFP-3 diesel air starting system. LRA Table 2.3.3-26 identifies the components subject to an AMR for the EFP-3 diesel air starting system by component type and intended function.

2.3.3.26.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.26, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the EFP-3 diesel air starting system in RAI 2.3-03 and RAI 2.3-06, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-03 and RAI 2.3-06 can be found in SER Section 2.3.

2.3.3.26.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EFP-3 diesel air starting system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.27 Decay Heat Closed-Cycle Cooling System

2.3.3.27.1 Summary of Technical Information in the Application

The decay heat closed-cycle cooling system removes decay heat released by the reactor core during cooldown following a shutdown and during refueling. The system provides for the removal of decay heat by transferring heat from the decay heat removal system to the nuclear service and decay heat sea water system. The decay heat closed-cycle cooling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.27 describes the decay heat closed-cycle cooling system. LRA Table 2.3.3-27 identifies the components subject to an AMR for the decay heat closed-cycle cooling system by component type and intended function.

2.3.3.27.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.27, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the decay heat closed-cycle cooling system in RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06 can all be found in SER Section 2.3.

In RAI 2.3.3.27-01 dated October 15, 2009, the staff noted that connected piping to the decay heat closed-cycle cooling system was within the scope of license renewal, based on 10 CFR 54.4(a)(2). However, in two locations, the second valve in the connection series (DCV-212 and DCV-213) was not depicted as within scope for license renewal under 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why these valves are not included within scope.

In its response dated November 12, 2009, the applicant stated that the valves in question should have been depicted on the system drawings as within the scope of license renewal under 10 CFR 54.4(a)(2). The applicant also indicated that the valves are included in LRA Table 2.3.3-27 under the "piping, piping components, and piping elements" component and commodity group.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.27-01 acceptable because the applicant clarified that the valves, DCV-212 and DCV-213, are included within the scope of license renewal under 10 CFR 54.4(a)(2) and are included on LRA Table 2.3.3-27. Therefore, the staff's concern described in RAI 2.3.3.27-01 is resolved.

2.3.3.27.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the decay heat closed-cycle cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.28 Fuel Oil System

2.3.3.28.1 Summary of Technical Information in the Application

The fuel oil system provides diesel fuel to the EDGs, the emergency feed pump diesel, and the alternate AC (AAC) diesel. The AAC diesel performs no license renewal intended function and, therefore, is not within the scope of license renewal. The fuel oil system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs; (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function; and (3) perform functions that support fire protection, SBO, and EQ.

LRA Section 2.3.3.28 describes the fuel oil system. LRA Table 2.3.3-28 identifies the components subject to an AMR for the fuel oil system by component type and intended function.

2.3.3.28.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.28, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the fuel oil system in RAI 2.3-01, RAI 2.3-04, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-01, RAI 2.3-04, and RAI 2.3-06 can all be found in SER Section 2.3.

2.3.3.28.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the fuel oil system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.29 Jacket Coolant System

2.3.3.29.1 Summary of Technical Information in the Application

The jacket coolant system is divided into parts associated with the supported diesel engine: the EDGs, the EFP diesel, and the AAC diesel. The system removes heat from the supported diesel engines. The jacket coolant system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support SBO.

LRA Section 2.3.3.29 describes the jacket coolant system. LRA Table 2.3.3-29 identifies the components subject to an AMR for the jacket coolant system by component type and intended function.

2.3.3.29.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.29, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the jacket coolant system in RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-03, RAI 2.3-04, and RAI 2.3-06 can all be found in SER Section 2.3.

2.3.3.29.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the jacket coolant system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.30 Diesel Generator Lube Oil System

2.3.3.30.1 Summary of Technical Information in the Application

The diesel generator lube oil system is divided into parts associated with the supported diesel engine: the EDGs, the EFP diesel, and the AAC diesel. The system provides lubrication when the supported diesel engines are in operation and maintains lubrication under standby conditions. The diesel generator lube oil system contains components that: (1) are safety-related components and are relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support SBO.

LRA Section 2.3.3.30 describes the diesel generator lube oil system. LRA Table 2.3.3-30 identifies the components subject to an AMR for the diesel generator lube oil system by component type and intended function.

2.3.3.30.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.30, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the diesel generator lube oil system in RAI 2.3-04, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.30.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the diesel generator lube oil system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.31 Domestic Water System

2.3.3.31.1 Summary of Technical Information in the Application

The domestic water system supplies water to the intake area, plant buildings, and a domestic water storage tank. The domestic water system contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.31 describes the domestic water system. LRA Table 2.3.3-31 identifies the components subject to an AMR for the domestic water system by component type and intended function.

2.3.3.31.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.31.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the domestic water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.32 Demineralized Water System

2.3.3.32.1 Summary of Technical Information in the Application

The demineralized water system supplies a constant source of deaerated, demineralized water to provide clean flushing and makeup water to various systems and structures, including the:

- condensate system
- spent fuel pool cooling system
- makeup and purification system
- decay heat closed-cycle cooling system
- nuclear services closed-cycle cooling system
- industrial cooling system
- nuclear service and decay heat sea water system pumps

The demineralized water system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.32 describes the demineralized water system. LRA Table 2.3.3-32 identifies the components subject to an AMR for the demineralized water system by component type and intended function.

2.3.3.32.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.32, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the demineralized water system in RAI 2.3-01, RAI 2.3-03, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-01, RAI 2.3-03, and RAI 2.3-06 can all be found in SER Section 2.3.

In RAI 2.3.3.32-01 dated October 15, 2009, the staff noted that numerous demineralized water system area exclusions were identified. However, these area exclusions are not described in any detail. The applicant was requested to provide additional justification to explain why certain demineralized water system components are not included within the scope of license renewal. In its response dated November 12, 2009, the applicant stated that:

> CR-3 has revised its methodology for spatial interaction scoping to narrowly permit exclusions only in areas where there are no safety related components; that are adequately protected and isolated from other areas of the plant; and are adequately equipped with drain systems which are themselves in the scope of license renewal. This issue was previously addressed in RAI 2.1-2, dated August 20, 2009 and the applicant response, dated September 18, 2009. Based on these criteria, spatial interaction scoping exclusions associated with the demineralized water system are limited to three demineralized water supply valves (DWV-235, DWV-237, and DWV-238) and associated piping located in the radwaste processing area of the auxiliary building. The balance of demineralized water system piping components located inside seismic class 1 structures has been included in license renewal scope. These components are represented by the piping, piping components, piping elements, and tanks component and commodity group.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.32-01 acceptable because the applicant defined the area exclusions and the involved components. The applicant also included components, which were previously excluded, within scope under 10 CFR 54.4(a)(2) and provided that the components are listed as line items on LRA Table 2.3.3-32 under the "piping, piping components, piping elements, and tanks" component and commodity group. Therefore, the staff's concern described in RAI 2.3.3.32-01 is resolved.

2.3.3.32.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the demineralized water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.33 Emergency Diesel Generator System

2.3.3.33.1 Summary of Technical Information in the Application

The EDG system consists of the EDGs, AAC diesel generator, and emergency operations facility diesel generator. The EDGs provide AC electrical power to 4,160-V ES buses in order to provide motive and control power to equipment required for safe shutdown of the plant and the mitigation and control of postulated accidents following a loss of offsite power (LOOP) or degraded grid voltage condition. The EDG system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.33 describes the EDG system. LRA Table 2.3.3-33 identifies the components subject to an AMR for the EDG system by component type and intended function.

2.3.3.33.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.33, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the EDG system in RAI 2.3-06, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-06 can be found in SER Section 2.3.

In RAI 2.3.3.33-01 dated August 14, 2009, the staff noted that the AFW pump was depicted as being within the scope of license renewal. However, the power sources for the AFW pump and the AAC diesel and building are not identified as within the scope of license renewal. In FSAR Section 10.6.1, the AFW pump is designed to provide an additional nonsafety grade source of secondary cooling to the OTSGs should a loss of all main and EFW occur. This AFW source was added in response to staff concerns on the issue of EFW reliability (GSI 124 and SRP-LR Section 10.4.9).

In addition, the AAC may be credited as backup power supply to the EDG in the event of a loss of all AC. License Amendment 207, regarding TS change request for EDG allowed outage time extension (from 72 hours to 14 days), issued June 13, 2003, indicates that the "AAC diesel is intended to provide defense in depth during EDG online maintenance and other times when it is available. The AAC diesel will be capable of carrying the loads required for safe shutdown, including maintaining adequate voltage and frequency such that the performance of safety systems is not degraded." The technical evaluation for this licensing amendment included a probabilistic safety assessment evaluation which incorporated the availability of the AAC diesel. License Amendment 228, issued on December 26, 2007, by the staff, involved the measurement uncertainty recapture power uprate, which referenced the AAC diesel. The applicant noted that the AAC diesel can be aligned to either safety-related AC distribution buses.

Though it is noted in the FSAR that the AAC diesel does not have an SBO function, it is relied upon in subsequent license amendment requests to provide defense-in-depth for the EDG system. The applicant was requested to explain the exclusion of the AAC diesel system and the AAC diesel generator building from the scope of license renewal.

In its response dated September 11, 2009, the applicant stated that the AAC diesel generator is capable of providing power to AFW pump FWP-7, but FWP-7 itself is nonsafety-related. The AAC source is intended to provide defense-in-depth during EDG online maintenance, and other times when it is available, and is not intended to be used to change the CR-3 licensing basis for compliance with SBO. The applicant also indicated that the AAC diesel generator is not required to supply any accident loads or safe shutdown loads in the event of a fire or seismic event.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.33-01 acceptable because the applicant stated that the AAC diesel generator is not credited with mitigating any DBEs, in accordance with 10 CFR 54.4. Subsequently, the AAC diesel generator building is not included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.33-01 is resolved.

2.3.3.33.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EDG system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.34 Floor Drains System

2.3.3.34.1 Summary of Technical Information in the Application

The floor drains system is a subsystem of the radioactive liquid waste disposal system. Equipment drains are considered part of the floor drains system and are shown on the same drawings. The purpose of the radioactive liquid waste disposal system is to collect, store, and process radioactive liquid wastes for reuse or disposal. The following are collection points for the floor drains system: RB sump, AB sump, decay heat pit sump, and laundry/hot shower sump. Each of these listed sumps contains remote liquid level indicators and level alarms. The floor drains system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.3.34 describes the floor drains system. LRA Table 2.3.3-34 identifies the components subject to an AMR for the floor drains system by component type and intended function.

2.3.3.34.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.34, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that

the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the floor drains system in RAI 2.3-05, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-05 can be found in SER Section 2.3.

2.3.3.34.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the floor drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.35 Fuel Handling System

2.3.3.35.1 Summary of Technical Information in the Application

The fuel handling system is designed to provide a safe, effective means of transporting and handling fuel from the time it arrives onsite, in a non-irradiated condition, until it can be transferred to an onsite or offsite storage location, after post-irradiation cooling. The fuel handling system contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.35 describes the fuel handling system. LRA Table 2.3.3-35 identifies the components subject to an AMR for the fuel handling system by component type and intended function.

2.3.3.35.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.35 and the FSAR using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In RAI 2.3.3.35-01 dated August 14, 2009, the staff noted that in LRA Section 2.3.3.35, the applicant stated, "…that there were no license renewal scoping drawings that depict the Fuel Handling System," yet license renewal drawing 302-621-LR, sheet 1 shows the fuel transfer canal. The staff also noted that LRA Table 2.3.3-35 lists "Containment isolation piping and components" as a component type for the fuel handling system. The staff requested that the applicant verify that license renewal drawing 302-621-LR depicts all the components for the fuel handling system that are included within the scope of license renewal and any components that were excluded from the scope of license renewal.

In its response dated September 11, 2009, the applicant acknowledged that the license renewal drawing depicts the two fuel transfer tubes and associated piping, valves, and fittings as within the scope of license renewal and submitted an amendment to the LRA to identify the scoping boundaries on the correct license renewal drawing. In its response dated November 12, 2009, the applicant stated that LRA Section 2.3.3.35 was inaccurate and should have stated, “The License Renewal scoping boundaries for the Fuel Handling System are shown on the following scoping drawing. (Scoping drawings have been submitted separately for information only.) 302-621-LR, Sheet 1.” The applicant stated that the two fuel transfer tubes are included within scope in the fuel handling system; but the associated piping, valves, and fittings are included within scope in the spent fuel cooling system.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.35-01 acceptable because the applicant amended the LRA and explained that the correct drawing reference for the fuel transfer tubes and the associated piping, valves, and fittings are included within the scope of license renewal under the fuel handling system and the spent fuel cooling system, respectively. Therefore, the staff’s concern described in RAI 2.3.3.35-01 is resolved.

2.3.3.35.3 Conclusion

The staff reviewed the LRA, FSAR, and RAI response to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the fuel handling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.36 Fire Protection System

2.3.3.36.1 Summary of Technical Information in the Application

Fire protection is accomplished through fire prevention, fire detection and suppression, and compartmentalization. Fire protection features include, but are not limited to, a fire water supply system, fire detection systems, automatic fire suppression systems (including gaseous suppression), manual fire suppression systems, and fire barriers.

The fire protection water originates from wells and is stored in two fire service water storage tanks which contain water dedicated to fire protection. Three fire protection pumps, two diesel-driven and one electric motor-driven, provide firefighting water and are located in a pump house that is separate from other plant buildings and structures. A 30 gallon per minute (gpm) motor-driven jockey pump maintains a minimum pressure in the fire protection system under no-use conditions. The fire protection water piping penetrates the RB and, therefore, the system contains components that form part of the containment pressure boundary.

Fire detection systems use ionization photoelectric smoke detectors, thermal, and line-type heat detection devices which are installed to provide early warning of fire through local and remote audio and visual alarms, provide initiation signals to automatic suppression systems, and provide signals to actuate fire dampers or shut down air handling equipment.

Automatic fire suppression subsystems include fixed water spray systems and automatic sprinkler systems, as well as a fixed Halon 1301 fire suppression system in the cable spreading room in the CC. Manual fire suppression involves the use of fire protection equipment, such as fixed water spray systems, fire extinguishers, standpipes and hose stations, fire hydrants, fire carts, and foam carts, to be used by trained fire brigade personnel.

Fire barriers are used to create compartmentalization for defense-in-depth fire protection. Fire barriers include fire rated walls, floors, ceilings, cable tray and conduit wraps, fire doors, fire dampers, and penetration seals around electrical and mechanical components.

LRA Section 2.3.3.36 describes the fire protection system. LRA Table 2.3.3-36 identifies the components subject to an AMR for the fire protection system by component type and intended function.

2.3.3.36.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.36, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff also reviewed the CR-3 fire protection CLB documents listed in the CR-3 Operating License Condition 2.C(9). This review included CR-3 commitments to 10 CFR 50.48, "Fire Protection" (i.e., approved fire protection program), as provided in the responses to Appendix A to theBranch Technical Position (BTP), Auxiliary and Power Conversion Systems Branch (APCSB), 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976, documented in the CR-3 SERs dated July 27, 1979; January 22, 1981; January 6, 1983; July 18, 1985; March 16, 1988; and October 29, 1997.

During its review of LRA Section 2.3.3.36, the staff identified areas in which additional information was necessary to complete its review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.36-1 dated August 31, 2009, the staff stated that the license renewal drawing 302-231-LR, sheet 1 shows automatic water spray systems for oil-filled yard transformers at locations A7, A8, and A9 as out of scope. The staff requested that the applicant verify whether the automatic water spray systems are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If these suppression systems are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated September 30, 2009, the applicant stated that water spray systems for the oil-filled yard transformers identified on license renewal drawing 302-231-LR, sheet 1, coordinates A7, A8, and A9 are within the scope of license renewal and are highlighted on the subject drawing as subject to an AMR. The highlighted piping and valves are included in LRA Tables 2.3.3-36 and 3.3.2-36 in the following component/commodity groups: (1) piping, piping components, standpipes, hydrants, and tanks and (2) sprinkler heads and spray nozzles. The non-highlighted dashed lines on license renewal drawing 302-231-LR, sheet 1, at coordinates A7, A8, and A9, represent electrical transformers and fire walls. Electrical components and fire walls are not highlighted on mechanical scoping drawings.

Based on the review, the staff finds the applicant's response to RAI 2.3.3.36-1 acceptable. The applicant clarified that the water spray systems for the oil-filled yard transformer components in question are within the scope of license renewal and are subject to an AMR. The staff's concern described in RAI 2.3.3.36-1 is resolved.

In RAI 2.3.3.36-2 dated August 31, 2009, the staff noted that "… a fixed, automatic Halon 1301 fire suppression system is installed to protect the Cable Spreading Room in the Control Complex..." Furthermore, in the SER dated July 27, 1979, Section 5.11, "Cable Spreading Room," it states that "…a back[up] Halon 1301 agent supply that would allow a second manual discharge if automatic release of the primary supply is ineffective…" The automatic and manual Halon 1301 fire suppression systems do not appear in license renewal drawings as being within the scope of license renewal and subject to an AMR. The staff requested that the applicant verify whether the above Halon 1301 fire suppression systems are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated September 30, 2009, the applicant stated that the Halon 1301 fire suppression systems described in LRA Section 2.3.3.36 are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). The Halon 1301 fire suppression systems are not represented on either license renewal drawings or CR-3 flow diagrams. Each distinct Halon tank in the cable spreading room is connected by short pieces of pipe to a discharge nozzle. The Halon system bottles and discharge piping are included in the LRA Tables 2.3.3-36 and 3.3.2-36 component/commodity group, "Piping, piping components, standpipes, hydrants, and tanks."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.36-2 acceptable because it indicated that the Halon 1301 fire suppression systems in question are within the scope of license renewal and subject to an AMR. The staff's concern described in RAI 2.3.3.36-2 is resolved.

In RAI 2.3.3.36-3 dated August 31, 2009, the staff stated that LRA Table 2.3.3.36 excludes several types of fire barrier components that appear in LRA Section 2.3.3.36. LRA Section 2.3.3.36 states that, "Fire barrier assemblies may consist of material such as Thermo-lag or TSI Barriers, Mecatiss Fire Barriers, pyrocrete, ceramic fiber, Marinite, concrete/grout, or sprayed on coatings…" The staff requested that the applicant verify whether the above fire barrier assemblies are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated September 30, 2009, the applicant stated that:

> Fire barrier assemblies for in-scope structures are in the scope of license renewal, subject to an AMR, and evaluated as a civil component/commodity. As stated in LRA Subsection 2.3.3.36 page 2.3-94, "...Fire Barrier Assemblies ... are

civil components/commodities and are addressed with their associated structures in Section 2.4." Specifically, Fire Barrier Assemblies are identified in the following structures in LRA Sections 2.4 (Scoping/Screening) and 3.5 (AMR):

LRA Tables		Structure
2.4.1-1	3.5.2-1	Reactor Building
2.4.2-2	3.5.2-2	Auxiliary Building
2.4.2-5	3.5.2-6	Control Complex
2.4.2-13	3.5.2-14	Intermediate Building

Structure	Fire Barrier Assemblies Include:
Reactor Building	Thermo-Lag fire barrier on conduits, junction boxes, transmitters, and penetrations encapsulated by stainless steel.
Auxiliary Building Intermediate Building	Thermo-Lag fire barrier on conduits, junction boxes, instrument tubing, supports, and mechanical equipment, and Mecatiss fire barriers on Thermo-Lag material on cable trays, conduits, junction boxes, instrument tubing, and supports.
Control Complex	Mecatiss fire barriers on Thermo-Lag material on cable trays, conduits, junction boxes, instrument tubing, and supports.

In addition, the applicant stated that the only fire barrier assemblies that are used at CR-3 are the Thermo-Lag fire barriers and the Mecatiss fire barrier system.

Furthermore, the applicant stated that during the review of this RAI response, it was determined there are no fire barrier assemblies located in the EFW pump building. The applicant revised the LRA to delete the fire barrier assemblies from LRA Tables 2.4.2-10 and 3.5.2-11.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.36-3 acceptable because it clarified that applicable fire barrier types are within the scope of license renewal and subject to an AMR. These fire barriers are evaluated in LRA Sections 2.4 and 3.5. LRA Section 2.3.3.36 indicates the difference between a fire barrier and a fire barrier assembly. Fire barriers take the form of fire rated walls, floors, ceilings, cable tray and conduit wraps, fire doors, fire dampers, and seals around electrical and mechanical components that pass through fire barriers. Fire barrier assemblies are composite structures or combinations of various components assembled to function as a fire barrier. Further, the staff confirmed that the fire barrier assemblies in question are evaluated as a civil component/commodity in LRA Section 2.4 (scoping/screening results) and that LRA Section 3.5 identifies the material, environment, and aging effect requiring aging management for these fire barrier assemblies. Therefore, the staff's concern described in RAI 2.3.3.36-3 is resolved.

In RAI 2.3.3.36-4 dated August 31, 2009, the staff stated that the SER dated July 27, 1979, listed the following types of fire water suppression systems provided in various plant areas for fire suppression activities:

- automatic wet pipe sprinkler system in fire pump house
- automatic pre-action sprinkler system in diesel generator control rooms

- automatic water spray systems for turbine lube oil system, piping, reservoir and oil purifier, hydrogen seal oil unit, feedwater pump consoles, and charcoal filter plenums in the CC

- automatic sprinkler system(s) beneath cable trays in the AB at elevations 95 and 119 feet

- automatic sprinkler system in Zone 5 of the IB at elevation 119 feet

- standpipe systems inside the reactor containment building

- manual fixed water spray systems in charcoal filter plenums in the AB

The staff requested that the applicant verify whether the fire suppression systems installed in the above areas of the plant are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated September 30, 2009, the applicant stated that the fire water suppression systems located in the referenced areas of the fire service pump house, diesel generator building, TB, CC, AB, IB, and RB are within the scope of license renewal and subject to an AMR. These fire suppression systems are identified on license renewal drawings 302-231-LR, sheet 1; 302-231-LR, sheet 2; and 302-232-LR, sheet 1 and are also described in FSAR Section 9.8. The applicant stated that the CR-3 fire hazards analysis identifies fire zones 201A and 201 B (instead of Zone 5) at elevation 119 feet in the IB using a wet pipe sprinkler system providing for full area suppression.

The applicant further stated that the referenced fire water suppression systems are included in the component/commodity groups “Piping, piping components, standpipes, hydrants, and tanks” and “Sprinkler Heads and Spray Nozzles,” included in LRA Tables 2.3.3-36 and 3.3.2-36.

In reviewing the applicant’s response to the RAI, the staff found that each item in the RAI was addressed and resolved satisfactorily. The applicant indicated that fire suppression systems in question that are installed in various buildings/areas are within the scope of license renewal and subject to an AMR. The applicant further identified the associated components that are included in LRA Tables 2.3.3-36 and 3.3.2-36. Therefore, the staff concludes that the applicant correctly identified these fire suppression systems and the associated components as within the scope of license renewal and subject to an AMR. The staff’s concern described in RAI 2.3.3.36-4 is resolved.

In RAI 2.3.3.36-5 dated August 31, 2009, the staff stated that LRA Table 2.3.3.36 excludes several types of fire protection components that appear in the SER dated July 27, 1979, and license renewal drawings. These components are valves, couplings, fire hose connections, Halon 1301 storage bottles, dikes for oil spill confinement, floor drains and curbs for firefighting water, filter housings, cable tray fire stops, flame retardant coating for cables, fire retardant coating for structural steel supporting wall, floor, and ceiling, and passive components in the diesel fuel fire pump.

The staff requested that the applicant determine whether the component should be included in LRA Tables 2.3.3-36 and 3.3.2-36 and, if not, justify the exclusion.

In its response dated September 30, 2009, the applicant provided the results of scoping and screening for the listed fire protection system component types. The applicant stated that the commodity groups identified are evaluated under license renewal as mechanical discipline commodities and civil discipline commodities. Fire service system valves, pipe couplings, fire hose connections, Halon 1301 storage bottles, filter housings, and diesel-driven fire pump housings are evaluated in the mechanical discipline and are included in the component/commodity group “Piping, piping components, standpipes, hydrants, and tanks,” identified in LRA Tables 2.3.3-36 and 3.3.2-36. In a similar manner, civil discipline commodity groups are identified in the LRA with each structure and are not included in LRA Tables 2.3.3-36 and 3.3.2-36. A review of each of the civil fire protection components listed in the RAI above is discussed below.

The applicant stated that there are no dikes for an oil spill specifically identified within the scope of license renewal for oil spill confinement in the Fire Protection Program. Floor drains for firefighting water are included as “Floor Drains” in the scoping/screening tables for the applicable structures in LRA Section 2.4. The license renewal intended function for these floor drains is C-8, provide flood protection barrier (internal and external flooding event). Intended function definitions are provided in LRA Table 2.1-1. The floor drains in the following structures were included within the scope of license renewal: RB, AB, CC, diesel generator building, EFW pump building, dedicated EFW tank enclosure building, IB, and TB. Floor drains are identified in the AMR tables for the applicable structures in LRA Section 3.5. Curbs are included as “Concrete: Above Grade” in the scoping/screening tables for the applicable structures in LRA Section 2.4. Specifically, “Concrete: Above Grade” has been assigned to the C-13, provide spray shield or curbs for directing flow, license renewal intended function for the RB and the diesel generator building. “Concrete: Above Grade,” including curbs, is identified in the AMR tables for the applicable structures in LRA Section 3.5.

Cable tray fire stops are included as “Fire Barrier Penetration Seals” in the scoping/screening tables for the applicable structures in LRA Section 2.4. Fire barrier penetration seals serving as cable tray fire stops are included within the scope of license renewal in the following structures: AB, CC, diesel generator building, IB, and TB. Fire barrier penetration seals used for cable tray fire stops are identified in the AMR tables for the applicable structures in LRA Section 3.5.

The applicant stated that there are no flame retardant coatings for cables specifically identified within the scope of license renewal for the Fire Protection Program. As discussed in the response to RAI 2.3.3.36-3, fire barrier assemblies are used at CR-3 on the cable trays and conduit consisting of Thermo-Lag and the Mecatiss fire barrier systems.

There are no flame retardant coatings for structural steel specifically identified within the scope of license renewal for the Fire Protection Program. As discussed in the response to RAI 2.3.3.36-3, fire barrier assemblies are used at CR-3 on the cable trays, conduit, junction boxes, and instrument tubing, including the support steel, consisting of Thermo-Lag and the Mecatiss fire barrier systems.

In reviewing its response to RAI 2.3.3.36-5, the staff found that the applicant had addressed and resolved each item in the RAI, as discussed in the following paragraphs.

Although the description of the “piping,” “piping components,” “standpipes,” “hydrants,” and “tanks” line items provided in LRA Tables 2.3.3-36 and 3.3.3-36 does not list these components specifically, the applicant stated that it considers these line items to include the valves, pipe couplings, fire hose connections, Halon 1301 storage bottles, filter housings, and diesel-driven fire pump housings. LRA Table 3.3.3-36 provides the AMR results for these components. In addition, the applicant addressed floor drains for firefighting water, curbs, and cable tray fire stops in LRA Section 2.4. LRA Section 3.5 identifies AMR tables for the applicable structures for floor drains for firefighting water, curbs, and cable tray fire stops.

The staff found that the applicant did not include the following components in the line item descriptions in the LRA: (1) dikes for oil spill confinement; (2) flame retardant coating for cables; and (3) fire retardant coating for structural steel supporting walls, floors, and ceilings. Since the applicant stated these components are not used in the Fire Protection Program, the staff finds that the applicant appropriately omitted them from the scope of license renewal.

2.3.3.36.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the fire protection system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.37 Hydrogen Supply System

2.3.3.37.1 Summary of Technical Information in the Application

The hydrogen supply system functions to provide cooling to the turbine generator using the generator gas system and provide a hydrogen overpressure in the makeup and purification (MU&P) system makeup tank to ensure that a predetermined amount of dissolved hydrogen remains in the RCS. The failure of nonsafety-related components in the hydrogen supply system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.37 describes the hydrogen supply system. LRA Table 2.3.3-37 identifies the components subject to an AMR for the hydrogen supply system by component and intended function.

2.3.3.37.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.37 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.37.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the hydrogen supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.38 Instrument Air System

2.3.3.38.1 Summary of Technical Information in the Application

The IA system functions to provide: (1) an adequate supply of high quality, filtered control air to various safety and nonsafety-related air operated valves, tanks, dampers, controls, and instrumentation; (2) an adequate supply of high quality, filtered breathing air; and (3) an adequate supply of high quality, filtered seal air to the inflatable hurricane barrier boots. The IA system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and SBO.

LRA Section 2.3.3.38 describes the IA system. LRA Table 2.3.3-38 identifies the components subject to an AMR for the IA system by component type and intended function.

2.3.3.38.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.38, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In RAI 2.3.3.38-01 dated October 15, 2009, the staff noted that the backup air system for the atmospheric dump valves (ADVs) is within the scope of license renewal, based on 10 CFR 54.4(a)(2). However, in LRA Section 2.3.4.16, “Main Steam System,” the applicant identified the following two 10 CFR 54.4(a)(1) functions for the main steam system:

- The system provides relief capacity to protect the steam generators from overpressurization for a loss of electrical power.

- The system controls steam generator pressure and thereby provides a mechanism for controlled decay heat removal for a loss of electrical power, steam line failure, loss of coolant accident, feedwater line break, and steam generator tube failure.

The ADV support of the 10 CFR 54.4(a)(1) functions of the main steam system would seem to indicate that the backup air system should be included within the scope of license renewal under 10 CFR 54.4(a)(1). The applicant was requested to justify the exclusion of the backup air system as within the scope of license renewal under 10 CFR 54.4(a)(1).

In its response dated November 12, 2009, the applicant stated that:

> The ADV relief capacity or control functions are not required to mitigate any limiting FSAR accident. The backup bottled air system for the ADVs provides a backup source of motive power to comply with the operability requirements for the coping period following a Station Blackout (SBO), which is a 10 CFR 54.4(a)(3) function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.38-01 acceptable because the applicant stated that the ADVs are not required to mitigate any limiting FSAR accident. The backup air system is located in the TB and is within the scope of license renewal under 10 CFR 54.4(a)(3). Therefore, the staff's concern described in RAI 2.3.3.38-01 is resolved.

In RAI 2.3.3.38-02 dated October 15, 2009, the staff noted that the applicant provided 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2) functions as part of the response letter to the staff's RAI dated May 11, 2009. For the IA system, the applicant identified a 10 CFR 54.4(a)(1) function that indicates the system contains components associated with air reservoirs that provide an assured source of air to various safety-related components. Other than the main IA system receivers, no individual component air receivers were identified on the system drawings or in the AMR tables for the IA system. The applicant was requested to justify the exclusion of individual air reservoirs as within the scope of license renewal under 10 CFR 54.4(a)(1).

In its response dated November 12, 2009, the applicant stated that individual air reservoirs were not excluded from the scope of license renewal. The referenced air receivers are small, passive tanks and are included within the scope of license renewal in the system that these tanks service under the "piping, piping components, piping elements, and tanks" component and commodity group. The applicant provided several system examples.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.38-02 acceptable because the applicant stated where these air reservoirs are evaluated. The applicant also stated that the air reservoirs are included on the various component and commodity group tables under "piping, piping components, piping elements, and tanks." Therefore, the staff's concern described in RAI 2.3.3.38-02 is resolved.

2.3.3.38.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the IA system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.39 Reactor Coolant Pump Lube Oil Collection System

2.3.3.39.1 Summary of Technical Information in the Application

The RCP lube oil collection system collects lube oil from potential pressurized and unpressurized leakage sites on each RCP lube oil system. The failure of nonsafety-related components in the RCP lube oil collection system could prevent satisfactory accomplishment of a safety-related function. In addition, the RCP lube oil collection system performs functions that support fire protection.

LRA Section 2.3.3.39 describes the RCP lube oil collection system. LRA Table 2.3.3-39 identifies the components subject to an AMR for the RCP lube oil collection system by component type and intended function.

2.3.3.39.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.39, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.39.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RCP lube oil collection system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.40 Leak Rate Test System

2.3.3.40.1 Summary of Technical Information in the Application

The leak rate test system provides the capability to perform integrated leakage rate tests periodically during the life of the plant. The leak rate test system design allows for containment isolation of the system piping that penetrates the RB and for post-accident hydrogen control capability for the RB. The system can also be used for routine RB depressurization. The leak rate test system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.40 describes the leak rate test system. LRA Table 2.3.3-40 identifies the components subject to an AMR for the leak rate test system by component type and intended function.

2.3.3.40.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.40 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.40.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the leak rate test system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.41 Miscellaneous Drains System

2.3.3.41.1 Summary of Technical Information in the Application

The miscellaneous drains (MD) system receives liquid from the feedwater heater manual drains and feedwater side relief valves, and routes the liquid to the TB sump. The MD system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.3.41 describes the MD system. LRA Table 2.3.3-41 identifies the components subject to an AMR for the MD system by component type and intended function.

2.3.3.41.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the MD system in RAI 2.3-03 and RAI 2.3-06, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-03 and RAI 2.3-06 can be found in SER Section 2.3.

2.3.3.41.3 Conclusion

The staff reviewed the LRA, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the MD system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.42 Make Up & Purification System

2.3.3.42.1 Summary of Technical Information in the Application

The make-up and purification (MU&P) system controls the RCS inventory during all phases of normal operation, regulates boric acid concentration in the RCS, purifies the RCS, provides seal injection and return for the RCPs, provides fill water to the RCS and core flood tanks, provides a means of degasification of the RCS, provides a location for sampling the RCS, and is the point of chemical addition to the RCS. The MU&P system contains components that: (1) are safety-related components and are relied upon to remain functional during and following DBEs; (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function; and (3) perform functions that support fire protection, SBO, and EQ.

LRA Section 2.3.3.42 describes the MU&P. LRA Table 2.3.3-42 identifies the components subject to an AMR for the MU&P system by component type and intended function.

2.3.3.42.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.42, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the MU&P system in RAI 2.3-01, RAI 2.3-04, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-01, RAI 2.3-04, and RAI 2.3-06 can all be found in SER Section 2.3.

2.3.3.42.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the MU&P system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.43 Miscellaneous Mechanical & Structures System

2.3.3.43.1 Summary of Technical Information in the Application

The miscellaneous mechanical and structures system consists of various mechanical, electrical, and structural components that do not fall under a specific system designation. The only mechanical component in this system is the plant vent. The miscellaneous mechanical and structures system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and SBO.

LRA Section 2.3.3.43 describes the miscellaneous mechanical and structures system. LRA Table 2.3.3-43 identifies the components subject to an AMR for the miscellaneous mechanical and structures system by component type and intended function.

2.3.3.43.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.43 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.43.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the miscellaneous mechanical and structures system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.44 Nitrogen Supply System

2.3.3.44.1 Summary of Technical Information in the Application

The nitrogen supply system provides high-pressure and low-pressure nitrogen throughout the plant. The nitrogen supply system contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.44 describes the nitrogen supply system. LRA Table 2.3.3-44 identifies the components subject to an AMR for the nitrogen supply system by component type and intended function.

2.3.3.44.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.44, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.44.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the nitrogen supply system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.45 Penetration Cooling Auxiliary System

2.3.3.45.1 Summary of Technical Information in the Application

The penetration cooling auxiliary system is a support system to the penetration cooling system and consists entirely of four drain traps, two dampers, and associated commodities. Penetration cooling auxiliary system components have the potential for spatial interaction with safety-related components because they are located in the IB. The failure of nonsafety-related components in the penetration cooling auxiliary system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.45 discusses the penetration cooling auxiliary system. LRA Table 2.3.3-45 identifies the components subject to an AMR for the penetration cooling auxiliary system by component type and intended function.

2.3.3.45.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.45 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.45.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the penetration cooling auxiliary system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.46 Reactor Building Airlock System

2.3.3.46.1 Summary of Technical Information in the Application

The RB airlock system consists of two personnel airlocks and one equipment access hatch. The mechanical components within scope include valves, test connections, supporting piping components, and tubing on the personnel locks. The hatches and locks are considered civil/structural components in the RB structure and are addressed in SER Section 2.4. The RB airlock system contains components that are safety-related and relied upon to remain functional during and following DBEs.

LRA Section 2.3.3.46 discusses the RB airlock system. LRA Table 2.3.3-46 identifies the components subject to an AMR for the RB airlock system by component type and intended function.

2.3.3.46.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.46 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.46.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB airlock system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.47 Roof Drains System

2.3.3.47.1 Summary of Technical Information in the Application

The roof drains system removes water that may pond on the roofs to ensure the roof structures are not compromised by the water load. Roof drains discharge directly into the storm drainage system. The failure of nonsafety-related components in the roof drains system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.47 describes the roof drains system. LRA Table 2.3.3-47 identifies the components subject to an AMR for the roof drains system by component type and intended function.

2.3.3.47.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.47 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.47.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the roof drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.48 Radiation Monitoring System

2.3.3.48.1 Summary of Technical Information in the Application

The radiation monitoring system contributes to personnel protection and equipment monitoring by measuring and recording radiation levels and concentrations of radioactivity at selected areas or in selected processes to verify compliance to governing regulations. The radiation monitoring system detects, warns, and initiates control actions when radiation levels or radionuclide concentrations exceed predetermined levels. The radiation monitoring system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.48 describes the radiation monitoring system. LRA Table 2.3.3-48 identifies the components subject to an AMR for the radiation monitoring system by component type and intended function.

2.3.3.48.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.48, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that

the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.48.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the radiation monitoring system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.49 Nuclear Service and Decay Heat Sea Water System

2.3.3.49.1 Summary of Technical Information in the Application

The nuclear service and decay heat sea water system provides cooling water to the nuclear services closed-cycle cooling system heat exchangers and to the decay heat closed-cycle cooling system heat exchangers.

The functions of the nuclear service and decay heat sea water system are to: (1) provide cooling water to the nuclear services closed-cycle cooling system and decay heat closed-cycle cooling system for heat removal following a DBA, (2) provide cooling water to the nuclear services closed-cycle cooling system for heat removal during normal plant operations and to the decay heat closed-cycle cooling system for decay heat removal during normal plant shutdown, (3) provide dilution water to the waste disposal system effluent, (4) recirculate heated water back to the "b" pit to maintain nuclear services closed-cycle cooling system temperatures during normal operations, and (5) provide a post-accident monitoring function.

Cooling water for the nuclear service and decay heat sea water system is taken from the Gulf of Mexico through the intake canal. Sea water drawn from the intake canal is conveyed to the sump pit by two redundant 48-inch intake conduits. The nuclear service and decay heat sea water system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.49 describes the nuclear service and decay heat sea water system. LRA Table 2.3.3-49 identifies the components subject to an AMR for the nuclear service and decay heat sea water system by component type and intended function.

2.3.3.49.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.49, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that

the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the nuclear service and decay heat sea water system in RAI 2.3-03, RAI 2.3-05, and RAI 2.3-06, all dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to RAI 2.3-03, RAI 2.3-05, and RAI 2.3-06 can all be found in SER Section 2.3.

2.3.3.49.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the nuclear service and decay heat sea water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.50 Station Air System

2.3.3.50.1 Summary of Technical Information in the Application

The station air system provides air for breathing and supplies air to air-powered equipment throughout the plant. The station air system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection.

LRA Section 2.3.3.50 describes the station air system. LRA Table 2.3.3-50 identifies the components subject to an AMR for the station air system by component type and intended function.

2.3.3.50.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.50, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the station air system in RAI 2.3-03 and RAI 2.3-04, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-03 and RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.50.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the station air system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.51 Secondary Services Closed-Cycle Cooling Water System

2.3.3.51.1 Summary of Technical Information in the Application

The secondary services closed-cycle cooling water system removes heat from various components and transfers the heat to the circulating water system. The secondary services closed-cycle cooling water system is assumed to be operating in support of SGTR event mitigation. Also, the failure of nonsafety-related components in the secondary services closed-cycle cooling water system could prevent satisfactory accomplishment of a safety-related function. The secondary services closed-cycle cooling water system consists of two secondary services closed-cycle cooling pumps, two heat exchangers, a surge tank, a booster pump, a sample pump, a CA tank and pump, and piping components servicing system heat loads.

LRA Section 2.3.3.51 describes the secondary services closed-cycle cooling water system. LRA Table 2.3.3-51 identifies the components subject to an AMR for the secondary services closed-cycle cooling water system by component type and intended function.

2.3.3.51.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.51, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the secondary services closed-cycle cooling water system in RAI 2.3-04, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.51.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the secondary services closed-cycle cooling water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.52 Station Drains System

2.3.3.52.1 Summary of Technical Information in the Application

The station drains system collects liquids from various sources for disposal. The station drains system consists of the following components: the TB sump and associated sump pumps, the chemical storage tank area sump and associated sump pumps, the nuclear services area sump and associated sump pumps, the tendon access gallery sump and associated sump pumps, the intake electric vault sump and associated sump pump, the berm area sumps, the condensate pit sumps and associated sump pumps, the diesel generator sumps and associated sump pumps, the IB EFW pump sump and associated sump pump, the fire pump house sump, the EFPB sump and sump pump, and the oily water separator. The liquid waste in the TB sump is removed by the oily water separator and discharged to the station drains tank, where it is circulated, sampled, and pumped to the selected raw water system for release to the environment. The station drains system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.3.53 describes the station drains system. LRA Table 2.3.3-52 identifies the components subject to an AMR for the station drains system by component type and intended function.

2.3.3.52.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.52 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the station drains system in RAI 2.3-03, RAI 2.3-04, and RAI 2.3-05, all dated October 15, 2009, as one of the LRA systems with applicability to the staff’s generic inquiry to the applicant’s scoping and screening methodology for mechanical systems. The staff’s evaluations and resolutions to RAI 2.3-03, RAI 2.3-04, and RAI 2.3-05 can all be found in SER Section 2.3.

In RAI 2.3.3.52-01 dated October 15, 2009, the staff noted that two lines shown on the license renewal drawings appeared to exit a building through a dividing wall and are included within the scope of license renewal. The applicant was requested to describe where these lines go and if there were any additional components that should be included within the scope of license renewal.

In its response dated November 12, 2009, the applicant indicated that the two lines in question were routed to the nearest floor drains and exited the diesel generator building into the clean maintenance shop. These lines, located in the diesel generator building, are included within the scope of license renewal. The lines are included in LRA Table 2.3.3-52 as "piping, piping components, piping elements, and tanks."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.52-01 acceptable because the applicant indicated that the lines associated with the station drains system are included within the scope of license renewal. The applicant also identified their location in the diesel generator building. Therefore, the staff's concern described in RAI 2.3.3.52-01, concerning the station drains system, is resolved.

2.3.3.52.3 Conclusion

The staff reviewed the LRA, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the station drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.53 Spent Fuel Cooling System

2.3.3.53.1 Summary of Technical Information in the Application

The spent fuel cooling system is designed to remove the decay heat in the stored fuel and to maintain the water clarity in the spent fuel pools. The system is required to maintain sufficient spent fuel pool water level above an assumed failed fuel assembly lying on top of the spent fuel racks to afford iodine and particulate removal during a fuel handling accident. The spent fuel cooling system also limits radioactive fission products released to the outside environment following a fuel assembly rupture in the spent fuel pools. In addition, it assures that irradiated fuel assemblies in the spent fuel pools do not achieve a critical state. The spent fuel cooling system provides purification of the spent fuel pool water, the fuel transfer canal water, and the contents of the BWST. The system further provides a means for filling the fuel transfer canal and incore instrumentation pit during refueling operations.

The spent fuel cooling system consists of two spent fuel cooling pumps, two spent fuel cooling heat exchangers, a borated water recirculation pump, two filters, a demineralizer, and the interconnecting piping and valves required for system operation. The spent fuel cooling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection.

LRA Section 2.3.3.53 describes the spent fuel cooling system. LRA Table 2.3.3-53 identifies the components subject to an AMR for the spent fuel cooling system by component type and intended function.

2.3.3.53.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.53, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the spent fuel cooling system in RAI 2.3-04 and RAI 2.3-05, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-04 and RAI 2.3-05 can be found in SER Section 2.3.

In RAI 2.3.3.53-01 dated October 15, 2009, the staff noted that in the spent fuel cooling system license renewal drawing, the applicant indicated two components that appear to be heat exchangers in the spent fuel storage pools that were not included within the scope of license renewal. The applicant was requested to provide the function of these heat exchangers and justification for their exclusion from the scope of license renewal.

In its response dated November 12, 2009, the applicant indicated that the two components are not heat exchangers, but are gates. In a teleconference with the staff on December 10, 2009, the applicant further clarified that these spent fuel pool gates are not permanently installed, nor do they have an intended function for license renewal. In addition, the air lines that supply air to the inflatable seals on the gates are included within the scope of license renewal, under 10 CFR 54.4(a)(2), for spatial interactions only. The air seals are not included within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.53-01 acceptable because the applicant clarified the identity of the components and specifically indicated that the spent fuel pool gates associated with the spent fuel pool cooling system are not normally installed and do not have an intended function for license renewal; hence, they are not included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.53-01, concerning the spent fuel pool cooling system, is resolved.

2.3.3.53.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the spent fuel cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.54 Nuclear Services Closed-Cycle Cooling System

2.3.3.54.1 Summary of Technical Information in the Application

The nuclear services closed-cycle cooling system removes heat from various components and transfers this heat to the nuclear services and decay heat sea water system. The nuclear services closed-cycle cooling system is a closed loop system in order to prevent radioactive releases to the environment. The system functions are to: (1) remove heat from various safety-related equipment and apparatus following an ES actuation, (2) prevent the release of radioactivity by acting as an intermediate barrier, (3) remove heat from various components necessary for plant operation, (4) cool secondary services closed-cycle cooling water system loads (through a cross-connection with that system), and (5) provide cooling water to the 68 CRD mechanism stator water jacket assembly coolers.

The nuclear services closed-cycle cooling system contains four heat exchangers, a normal duty pump, two emergency duty pumps, two booster pumps, a surge tank, two filters, a radiation monitor, a PASS cooler, a demineralizer, valves, and piping. The nuclear services closed-cycle cooling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.54 describes the nuclear services closed-cycle cooling system. LRA Table 2.3.3-54 identifies the components subject to an AMR for the nuclear services closed-cycle cooling system by component type and intended function.

2.3.3.54.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.54, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the nuclear services closed-cycle cooling system in RAI 2.3-04, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-04 can be found in SER Section 2.3.

2.3.3.54.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the nuclear services closed-cycle cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.55 Waste Disposal System

2.3.3.55.1 Summary of Technical Information in the Application

The waste disposal system is completely encompassed by the radioactive liquid waste disposal system and, therefore, functions to support the radioactive liquid waste disposal system. The waste disposal system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.55 describes the waste disposal system. LRA Table 2.3.3-55 identifies the components subject to an AMR for the waste disposal system by component type and intended function.

2.3.3.55.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.55 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.55.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the waste disposal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.56 Radioactive Gas Waste Disposal System

2.3.3.56.1 Summary of Technical Information in the Application

The radioactive gas waste disposal system collects, stores, monitors, and releases gases evolved from the primary coolant and radioactive liquid waste disposal systems. The radioactive gas waste disposal system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.56 describes the radioactive gas waste disposal system. LRA Table 2.3.3-56 identifies the components subject to an AMR for the radioactive gas waste disposal system by component type and intended function.

2.3.3.56.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.56, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.56.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the radioactive gas waste disposal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.57 Radioactive Liquid Waste Disposal System

2.3.3.57.1 Summary of Technical Information in the Application

The radioactive liquid waste disposal system provides a means to process radioactive liquid waste prior to release and ensures that waste releases are performed in a controlled manner. The radioactive liquid waste disposal system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection and EQ.

LRA Section 2.3.3.57 describes the radioactive liquid waste disposal system. LRA Table 2.3.3-57 identifies the components subject to an AMR for the radioactive liquid waste disposal system by component type and intended function.

2.3.3.57.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.57, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.57.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the radioactive liquid waste disposal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.58 Reactor Coolant and Miscellaneous Waste Evaporator System

2.3.3.58.1 Summary of Technical Information in the Application

The reactor coolant and miscellaneous waste evaporator system, located in the AB, has been abandoned in place. The failure of nonsafety-related components in the reactor coolant and miscellaneous waste evaporator system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.58 describes the reactor coolant and miscellaneous waste evaporator system. LRA Table 2.3.3-58 identifies the components subject to an AMR for the reactor coolant and miscellaneous waste evaporator system by component type and intended function.

2.3.3.58.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.58 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.58.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the reactor coolant and miscellaneous waste evaporator system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.59 Waste Gas Sampling System

2.3.3.59.1 Summary of Technical Information in the Application

The waste gas sampling system monitors the waste gas decay tanks (WGDTs) and other tanks and volumes for explosive gas mixtures by analyzing the hydrogen and oxygen concentrations. The inservice WGDT is normally sampled continuously. A sample bomb can be used for obtaining pressurized samples for other analyses. The sample bomb can be connected to the various sample points supplying the gas sampling analyzer. Nitrogen is provided to each tank to maintain the levels below the flammability limit for hydrogen and oxygen. The waste gas sampling system consists of oxygen and hydrogen analyzers, a waste gas sampling pump, sample cooler, a programmable controller, and associated piping, valves, and instrumentation. The waste gas sampling system contains components that are: (1) safety-related and relied upon to remain functional during and following DBEs and (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.3.59 describes the waste gas sampling system. LRA Table 2.3.3-59 identifies the components subject to an AMR for the waste gas sampling system by component type and intended function.

2.3.3.59.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.59, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.59.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the waste gas sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.60 Waste Sampling System

2.3.3.60.1 Summary of Technical Information in the Application

The waste sampling system is completely encompassed by the post-accident containment atmospheric sampling system and, thus, it is considered to be a part of that system. The function of the waste sampling system is to support the post-accident containment atmospheric sampling system; therefore, it performs a post-accident monitoring function. The waste sampling system consists of two hydrogen analyzer line moisture separators, a moisture separator drain tank, gas monitors, various valves, and piping and instrumentation required for system operation. The waste sampling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.60 describes the waste sampling system. LRA Table 2.3.3-60 identifies the components subject to an AMR for the waste sampling system by component type and intended function.

2.3.3.60.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.60 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the waste sampling system in RAI 2.3-03, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-03 can be found in SER Section 2.3.

2.3.3.60.3 Conclusion

The staff reviewed the LRA, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the waste sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.61 Post Accident Containment Atmospheric Sampling System

2.3.3.61.1 Summary of Technical Information in the Application

The post-accident containment atmospheric sampling system consists of the post-accident liquid sampling system and the post-accident containment atmospheric sampling system. The post-accident containment atmospheric sampling system provides long-term information to determine the types and quantities of gases and fission products released to the RB atmosphere. The system is designed to provide a means of obtaining grab samples of various atmospheric effluents from the following sources: RB atmosphere, RB purge exhaust duct, and AB exhaust duct. The post-accident containment atmospheric sampling system provides containment isolation in the piping/tubing that penetrates the RB. Instrumentation in the system provides monitoring of the post-accident containment isolation valve position.

The post-accident containment atmospheric sampling system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ.

LRA Section 2.3.3.61 describes the post-accident containment atmospheric sampling system. LRA Table 2.3.3-61 identifies the components subject to an AMR for the post-accident containment atmospheric sampling system by component type and intended function.

2.3.3.61.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.61, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3.61.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the post-accident containment atmospheric sampling components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

LRA Section 2.3.4 identifies the steam and power conversion systems SCs within the scope of license renewal and subject to an AMR. The applicant described the supporting SCs of the steam and power conversion systems in the following LRA sections:

- 2.3.4.1, “Condenser Air Removal System”
- 2.3.4.2, “Auxiliary Steam System”
- 2.3.4.3, “Condensate Chemical Treatment System”
- 2.3.4.4, “Condensate System”
- 2.3.4.5, “Once-Through Steam Generator Chemical Cleaning System”
- 2.3.4.6, “Condensate and Feedwater Chemical Cleaning System”
- 2.3.4.7, “Condensate Demineralizer System”
- 2.3.4.8, “Emergency Feedwater System”
- 2.3.4.9, “Electrohydraulic Control System”
- 2.3.4.10, “Main Feedwater System”
- 2.3.4.11, “Gland Steam System”
- 2.3.4.12, “Gland Seal Water System”

- 2.3.4.13, “Heater Drains System”
- 2.3.4.14, “Heater Vents System”
- 2.3.4.15, “Main Feedwater Turbine Lube Oil System”
- 2.3.4.16, “Main Steam System”
- 2.3.4.17, “Relief Valve Vent System”
- 2.3.4.18, “Secondary Plant System”
- 2.3.4.19, “Cycle Startup System”
- 2.3.4.20, “Turbine Generator System”

The staff’s findings on its review of LRA Sections 2.3.4.1 through 2.3.4.20 are in SER Sections 2.3.4.1 through 2.3.4.20, respectively.

2.3.4.1 Condenser Air Removal System

2.3.4.1.1 Summary of Technical Information in the Application

The condenser air removal system operates to: (1) establish and maintain a vacuum in the main condenser by removing non-condensible gases, (2) provide a means of measuring the air in-leakage to the main condenser, and (3) provide a means of monitoring for steam generator tube leaks.

The condenser air removal system is assumed necessary for the satisfactory operation of the main condenser during recovery from an SGTR accident.

The condenser air removal system consists of two air removal pumps, two seal water pumps, associated pneumatic valves, four manual condenser air removal valves, and a radiation monitor. The condenser air removal system has piping and associated components installed in the AB where the potential for adverse spatial interaction is assumed to exist. Additionally, the system includes valves associated with the main condenser that are classified as required subsequent to an earthquake. As such, the failure of nonsafety-related components in the condenser air removal system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.1 describes the condenser air removal system. LRA Table 2.3.4-1 identifies the components subject to an AMR for the condenser air removal system by component type and intended function.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that

the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the condenser air removal system in RAI 2.3-03 and RAI 2.3-04, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-03 and RAI 2.3-04 can be found in SER Section 2.3.

2.3.4.1.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the condenser air removal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.2 Auxiliary Steam System

2.3.4.2.1 Summary of Technical Information in the Application

During startup and shutdown operation, when reactor power is less than 10 percent power, Unit 1 or 2 at the Crystal River Energy Complex normally supplies the auxiliary steam system from the high-pressure turbine exhaust of the selected operating unit. Once the reactor is above 10 percent, the main steam system normally supplies auxiliary steam to system loads. Low-pressure steam to the main feedwater pumps (MFPs) is supplied from the auxiliary steam system until the plant reaches approximately 80 percent power. Above 80 percent power, the low-pressure steam to the MFPs is supplied from reheat steam.

The auxiliary steam system consists of connecting piping from the main steam lines and fossil Units 1 and 2 to the system loads, system pressure regulating, control and isolation valves, and a desuperheater. Steam drain traps connected to the low points in the system collect moisture and route it to the condenser or a flash tank. Portions of the auxiliary steam system are required to operate during a postulated SBO event to bring the plant to safe shutdown condition by providing steam to the EFW pump turbine for emergency cooling. In addition, the auxiliary steam system is necessary for the satisfactory operation of the MFP and isolation of portions of the gland seal water system during recovery from an SGTR accident.

The auxiliary steam system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support EQ, fire protection, and SBO.

LRA Section 2.3.4.2 describes the auxiliary steam system. LRA Table 2.3.4-2 identifies the components subject to an AMR for the auxiliary steam system by component type and intended function.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the auxiliary steam system in RAI 2.3-04, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-04 can be found in SER Section 2.3.

2.3.4.2.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the auxiliary steam system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.3 Condensate Chemical Treatment System

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 describes the condensate chemical treatment system, which is primarily designed to inject hydrazine and amine solutions into the condensate line to maintain correct pH and dissolved oxygen concentrations in the turbine cycle. The system also provides: (1) capability for the bulk storage and transfer of aqueous amine solution to the amine batch tank, (2) automatic control of chemical feed rates, and (3) capability for dilution of concentrated chemicals.

The condensate chemical treatment system consists of an amine batch tank, an amine injection pump, a hydrazine injection pump, a spare chemical injection pump, an additional amine injection pump, and a hydrazine batch tank. The system is located in the TB. The condensate chemical treatment system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the condensate chemical treatment system in RAI 2.3-01, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-01 can be found in SER Section 2.3.

In RAI 2.3.4.3-01 dated October 15, 2009, the staff noted that LRA Section 2.3.4.3 indicates that the condensate chemical treatment system is located within the TB, but has components within scope under 10 CFR 54.4(a)(2) because the system has nonsafety-related components whose failure could prevent satisfactory accomplishment of the safety-related functions. LRA Figure 2.2-1 indicates that the hydrazine addition tank is within the scope of license renewal; however, "tank" is not included as a mechanical component type within the scope of license renewal. Yet, the hydrazine addition tank foundation was included within the scope of license renewal according to LRA Section 2.4.2.15. The applicant was requested to provide an explanation why the hydrazine tank foundation was included within the scope of license renewal and provide justification for the exclusion of the hydrazine addition tank from the scope of license renewal.

In its response dated November 12, 2009, the applicant indicated that the hydrazine batch tank, as referred to in LRA Section 2.3.4.3, is in the condensate chemical treatment system and is not within the scope of license renewal. However, the hydrazine addition tank is part of the condensate system and is included within the scope of license renewal in LRA Table 2.3.4.3 as "piping, piping components, piping elements, and tanks." The hydrazine addition tank is not adjacent to any Class I structure and is, therefore, not a seismic interaction concern. The hydrazine addition tank is included within the scope of license renewal as part of the condensate system, supporting the main condenser function in an SGTR event; consequently, its foundation is also within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-01 acceptable because the applicant explained that the hydrazine addition tank is included in LRA Table 2.3.4-3 under component type "piping, piping components, piping elements, and tanks." Therefore, the staff's concern described in RAI 2.3.4.3-01 is resolved.

In RAI 2.3.4.3-02 dated October 15, 2009, the staff noted that the LRA states that the 10 CFR 54.4(a)(2) function for the condensate chemical treatment system described pressure boundary seals, considered to be civil components, that support the CC habitability envelope. The applicant was requested to identify the components transitioning through these seals and identify any liquid-filled piping within the CC.

In its response dated November 12, 2009, the applicant indicated that the condensate chemical treatment system includes three in-scope (for license renewal) civil discipline fire barrier penetration seals located in the CC. These fire barrier penetration seals are age-managed as identified in LRA Table 3.5.2-6, "Containments, Structures, and Component Supports – Summary of Aging Management Evaluation – Control Complex." The applicant also indicated that the condensate chemical treatment system does not contain any liquid-filled piping inside the CC.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-02 acceptable because the applicant explained that the fire barrier penetration seals are age-managed and there is no liquid-filled piping in the condensate chemical treatment system within the CC. Therefore, the staff's concern described in RAI 2.3.4.3-02 is resolved.

2.3.4.3.3 Conclusion

The staff reviewed the LRA and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the condensate chemical treatment system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.4 Condensate System

2.3.4.4.1 Summary of Technical Information in the Application

The function of the condensate system is to collect condensed steam from the low-pressure turbines, feedwater pump turbines, heater drains, and leakoff from steam cycle equipment for use as condensate. The condensate system delivers the condensate through demineralizers and heaters to the main feedwater system deaerator for use as steam generator feedwater. The system provides cooling water to the gland steam condenser and a means of makeup to the condensate system from the demineralized water system. The condensate system provides a secondary water source for the EFW system in the event of a loss of the dedicated EFW tank. The system also provides radiological dose mitigation during SGTR recovery. The condensate system (including the main condensers) is credited for SGTR mitigation.

The condensate system consists of two main condensers with a hotwell in the bottom of each, two condensate pumps, one condensate storage tank, a condensate demineralizer train with six service vessels, one gland steam condenser, two parallel sets of three condensate heaters, and one deaerator. The condensate system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection.

LRA Section 2.3.4.4 describes the condensate system. LRA Table 2.3.4-3 identifies the components subject to an AMR for the condensate system by component type and intended function.

2.3.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.4, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the condensate system in RAI 2.3-01 and RAI 2.3-03, both dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluations and resolutions to both RAI 2.3-01 and RAI 2.3-03 can be found in SER Section 2.3.

2.3.4.4.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the condensate system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.5 Once-Through Steam Generator Chemical Cleaning System

2.3.4.5.1 Summary of Technical Information in the Application

The OTSG chemical cleaning system is designed to provide: (1) for the wet layup of the OTSGs, (2) permanent piping/connections to allow for chemical cleaning of the OTSGs, (3) for the recirculation and mixing of the layup chemicals, and (4) for sampling the chemical cleaning or passivation fluid.

The OTSG chemical cleaning system does not function during normal operating modes. The system is located in the IB and consists of one layup pump, one layup solution tank, piping, and valves. The OTSG chemical cleaning system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support SBO.

LRA Section 2.3.4.5 describes the OTSG chemical cleaning system. LRA Table 2.3.4-4 identifies the components subject to an AMR for the OTSG chemical cleaning system by component type and intended function.

2.3.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.5 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.5.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the OTSG chemical cleaning system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.6 Condensate and Feedwater Chemical Cleaning System

2.3.4.6.1 Summary of Technical Information in the Application

The condensate and feedwater chemical cleaning system provides nitrogen for layup of the feedwater heaters, feedwater pumps, OTSGs, and various components in the condensate system. The condensate and feedwater chemical cleaning system consists of piping and valves that provide a flow path for nitrogen from nitrogen cylinders to the condensate and the main feedwater systems. The system provides a pressure boundary function for systems that mitigate a postulated SGTR event. The failure of nonsafety-related components in the condensate and feedwater chemical cleaning system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.6 describes the condensate and feedwater chemical cleaning system. LRA Table 2.3.4-5 identifies the components subject to an AMR for the condensate and feedwater chemical cleaning system by component type and intended function.

2.3.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.6 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.6.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the condensate and feedwater chemical cleaning system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.7 Condensate Demineralizer System

2.3.4.7.1 Summary of Technical Information in the Application

The condensate demineralizer system removes dissolved solids, corrosion products, and suspended solids from the condensate system by ion exchange and filtering through beds of ion exchange resins. The condensate demineralizer system provides condensate that meets the required water quality to the main feedwater system in a controlled manner during normal operation. The system also provides radiological dose mitigation during SGTR recovery. The system consists of six demineralizer service vessels, two local control panels, one cation separation and regeneration tank, and one anion regeneration tank. The failure of nonsafety-related components in the condensate demineralizer system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.7 describes the condensate demineralizer system. LRA Table 2.3.4-6 identifies the components subject to an AMR for the condensate demineralizer system by component type and intended function.

2.3.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.7, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In RAI 2.3.4.7-01 dated October 15, 2009, the staff noted that an acid/caustic drain line was described in LRA Section 2.3.4.7. However, its location in the AB was not found on the system license renewal boundary drawings. The staff requested that the applicant identify the drain line and its location.

In its response dated November 12, 2009, the applicant indicated that LRA Section 2.3.4.7 referred to two drain lines, one acid and one caustic, associated with the condensate demineralizer system. Both lines have been cut, capped, and disconnected from the condensate demineralizer system. The applicant also noted that one drain line and its associated piping components that are associated with the neutralizer tank have been included within the scope of license renewal in accordance with the applicant's response to RAI 2.1-2, dated September 18, 2009. The second drain line is associated with a connection to the spare mix tank. The applicant noted that since the two cut, capped, and disconnected drain lines could not be confirmed as non-pressurized in the plant, both lines have been included within scope as nonsafety-related, pressure boundary components in Seismic Class I structures having the potential for spatial interactions with safety-related SSCs.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.7-01 acceptable because the applicant identified the drain lines and their location and included the drain lines within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.4.7-01 is resolved.

2.3.4.7.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the condensate demineralizer system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.8 Emergency Feedwater System

2.3.4.8.1 Summary of Technical Information in the Application

The EFW system is a standby system and is not operated in support of plant startup or normal operation. The EFW system components are automatically activated upon: (1) loss of main feedwater, (2) loss of main feedwater with LOOP, (3) main feedwater line break, (4) main steam line break, (5) small break loss of coolant accident (LOCA), or (6) ATWS mitigating system actuation circuitry (AMSAC) initiation. When actuated, the EFW system pumps take the feedwater from the dedicated EFW tank and discharge it to the OTSGs. The EFW system is required to automatically supply sufficient EFW to one or both of the OTSGs to remove reactor decay heat and cool down the RCS until suitable conditions are attained to start the decay heat removal system. The system also maintains the steam generator level during the transition from forced to natural circulation when the RCPs are tripped.

The EFW system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection, EQ, and SBO.

LRA Section 2.3.4.8 describes the EFW system. LRA Table 2.3.4-7 identifies the components subject to an AMR for the EFW system by component type and intended function.

2.3.4.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.8, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In RAI 2.3.4.8-01 dated October 15, 2009, the staff noted that the location of where the condensate system supply to the EFW pumps enters the IB is not identified. The staff requested that the applicant identify the location where the condensate system supply line to the EFW pumps enters the IB and indicate if there were any changes in the piping classification within the IB.

In its response dated November 12, 2009, the applicant indicated that the condensate supply line to the EFW pumps enters the IB between the connection to the auxiliary feedwater pump (which is installed in the TB) and the tee where it splits to go to EFP-1 and EFP-2 (which is located in the IB). The applicant also noted that the piping class break from Seismic Class III to Seismic Class I does not occur until downstream of the tee located inside the IB.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.8-01 acceptable because the applicant indicated that the location of where the piping classification changes on the condensate supply to the EFW pumps is in the IB; hence, no (a)(1) components on this line are in the TB. Therefore, the staff's concern described in RAI 2.3.4.8-01 is resolved.

2.3.4.8.3 Conclusion

The staff reviewed the LRA, FSAR, RAI responses, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EFW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.9 Electro-Hydraulic Control System

2.3.4.9.1 Summary of Technical Information in the Application

LRA Section 2.3.4.9 describes the electrohydraulic control (EHC) system, which supplies a motive force to position the turbine governor, throttle, reheat, and intercept valves in response to electronic commands. The EHC system uses a combination of solid-state components and high-pressure hydraulics to control steam flow through the main turbine. The EHC system consists of 16 turbine valve actuator assemblies, a high-pressure hydraulic fluid system, an interface with the auto-stop oil system, and a solid-state controller with a control panel. All of the EHC system components are located in the TB except the EHC step down transformer, which is located in the CC in a nonsafety-related cabinet. The failure of nonsafety-related components in the EHC system could prevent satisfactory accomplishment of a safety-related function.

2.3.4.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.9, the FSAR, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.9.3 Conclusion

The staff reviewed the LRA, FSAR, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the EHC system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.10 Main Feedwater System

2.3.4.10.1 Summary of Technical Information in the Application

The main feedwater system consists of two motor-driven feedwater booster pumps, two turbine-driven MFPs, a deaerator, a deaerating heater storage tank, feedwater heaters, control and isolation valves, and connecting piping. Each 55-percent capacity feedwater booster pump takes suction from the deaerating storage tank and pumps through redundant trains of intermediate pressure heaters to the suctions of the turbine driven MFPs. Feedwater is then pumped through the high-pressure heaters to the feedwater regulating valves and into the OTSGs. A recirculation line to the deaerating heater storage tank is provided for each MFP and feedwater booster pump.

The primary operational function of the main feedwater system is to automatically maintain the required water level in the OTSGs during normal plant operation. Components in the main feedwater system provide the containment isolation function and support the main condenser function of providing radiological dose mitigation following a postulated SGTR event. The main feedwater system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, (3) perform functions that support fire protection, EQ, and SBO.

LRA Section 2.3.4.10 describes the main feedwater system. LRA Table 2.3.4-8 identifies the components subject to an AMR for the main feedwater system by component type and intended function.

2.3.4.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.10, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the main feedwater system in RAI 2.3-03, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-03 can be found in SER Section 2.3.

2.3.4.10.3 Conclusion

The staff reviewed the LRA, FSAR, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the main feedwater system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.11 Gland Steam System

2.3.4.11.1 Summary of Technical Information in the Application

The gland steam system has no safety-related functions. All of the mechanical components are located in the TB. The gland steam system supports mitigation of offsite dose during an SGTR accident by providing sealing steam for the main turbine gland seals, MFP gland seals, and main turbine and MFP turbine control valve stem seals to prevent both air in-leakage to the main condenser and steam leakage to the TB. The failure of nonsafety-related components in the gland steam system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.11 describes the gland steam system. LRA Table 2.3.4-9 identifies the components subject to an AMR for the gland steam system by component type and intended function.

2.3.4.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.11 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.11.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the gland steam system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.12 Gland Seal Water System

2.3.4.12.1 Summary of Technical Information in the Application

The gland seal water system supplies gland seal water to the MFPs, feedwater booster pumps, condensate pumps, and valves for sealing the packing glands that are exposed to main condenser vacuum. Also, the system supplies cooling water to the auxiliary steam system and gland steam system superheaters and for spray flow to the exhaust hood area of the low-pressure turbines. The system also supplies sealing water to the condensate, main steam, extraction steam, auxiliary steam, EFW, condenser air removal, and heater drains system valves for sealing the packing glands. The gland seal water system consists of two condensate injection pumps, two seal water return pumps, two duplex strainers, a seal drain return pot, a seal water return unit, and system level and pressure control valves. The gland seal water system aids in mitigating the offsite dose during an SGTR accident. The failure of nonsafety-related components in the gland seal water system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.12 describes the gland seal water system. LRA Table 2.3.4-10 identifies the components subject to an AMR for the gland seal water system by component type and intended function.

2.3.4.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.12 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.12.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the gland seal water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.13 Heater Drains System

2.3.4.13.1 Summary of Technical Information in the Application

LRA Section 2.3.4.13 describes the heater drains system, which consists of four high-pressure reheater drain tanks, four low-pressure reheater flash tanks, valves, controls, instrumentation, and associated piping. The heater drains system drains, collects, and returns condensate to the main feedwater system. The failure of nonsafety-related components in the heater drains system could prevent satisfactory accomplishment of a safety-related function.

2.3.4.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.13 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.13.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the heater drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.14 Heater Vents System

2.3.4.14.1 Summary of Technical Information in the Application

LRA Section 2.3.4.14 describes the heater vents system, which is part of the heater drains system. The heater vents system provides vent paths that allow the extraction steam to cascade by gravity through the drains, after the steam has given up its energy to the condensate and feedwater, to the next lower pressure heater. The heater vents remove non-condensible gases from the feedwater heaters. The heater vents system contains safety-related components that are relied upon to remain functional during and following DBEs.

2.3.4.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.14 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.14.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the heater vents system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.15 Main Feedwater Turbine Lube Oil System

2.3.4.15.1 Summary of Technical Information in the Application

The main feedwater turbine lube oil system provides lubricating oil to reduce bearing friction and remove bearing heat in both the MFP and turbine assemblies, and the feedwater booster pumps. The system also provides oil to the MFP turbine control oil system. The oil system for each MFP consists of a reservoir, two oil coolers, two filters, a 3-way transfer valve, pressure regulators, accumulators, and manual and solenoid trip and test valves. The two AC-powered oil pumps and one direct current (DC)-powered oil pump associated with the main feedwater turbine lube oil system are housed within the boundary of the associated oil reservoir.

The oil system for each feedwater booster pump consists of a reservoir, oil cooler, filters, and valves. There is a shaft driven oil pump and auxiliary oil pump associated with each feedwater booster pump. The oil pumps for both the feedwater booster pumps and the MFPs are considered to be part of the main feedwater system (refer to LRA Table 2.3.4-8). The failure of nonsafety-related components in the main feedwater turbine lube oil system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.15 describes the main feedwater turbine lube oil system. LRA Table 2.3.4-11 identifies the component types subject to an AMR for the main feedwater turbine lube oil system by component type and intended function.

2.3.4.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.15 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.15.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the main feedwater turbine lube oil system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.16 Main Steam System

2.3.4.16.1 Summary of Technical Information in the Application

The main steam system serves primarily to deliver steam from the OTSGs to the high-pressure turbine. There are two main steam lines from each of two OTSGs supplying steam to the main turbine for a total of four lines. Each main steam line is provided with main steam safety valves. Controlled steam relief to the atmosphere is provided by two atmospheric dump valves, which can be operated by backup high-pressure bottles. Steam can be bypassed to the main condenser with four turbine bypass valves. The system can supply steam to the EFW pump turbine with required flow available from either steam generator. The four main steam isolation valves are located within the Seismic Class I IB.

Operational functions of the main steam system include:

- supply steam to the turbine generator for power generation
- provide steam temperature and pressure control during hot standby and plant cooldown by controlled dumping of steam to either the main condenser or the atmosphere
- supply steam to turbine generator auxiliary systems
- supply steam to the moisture separator reheaters
- supply steam to the MFP turbines
- provide the means of OTSG secondary side blowdown for water chemistry control
- supply steam to the deaerator when extraction steam is not available
- supply steam to the auxiliary steam system during plant power escalation

Safety functions of the main steam system include:

- provide automatic isolation of the steam generators for a steam line failure
- provide adequate relief capacity to protect the OTSGs from overpressurization
- control steam generator pressure and, thereby, provide a mechanism for controlled decay heat removal for a loss of electric power, steam line failure, LOCA, feedwater line break, and steam generator tube failure
- provide steam to the EFW turbine-driven pump for various plant event scenarios
- provide the capability for RCS cooldown and effluent release control for a steam generator tube failure

The main steam system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection, EQ, and SBO.

LRA Section 2.3.4.16 describes the main steam system. LRA Table 2.3.4-12 identifies the components subject to an AMR for the main steam system by component type and intended function.

2.3.4.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.16, the FSAR, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that

the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

In RAI 2.3.4.16-01 dated October 15, 2009, the staff noted that two components, labeled RM-G25/G28 on the system license renewal drawing, are within the scope of license renewal, based on 10 CFR 54.4(a)(1). However, these components are not specifically identified, nor are their intended functions listed.

In its response dated November 12, 2009, the applicant indicated that the two components are main steam line radiation monitors and a sample line from the main steam system is routed past the monitors. These radiation monitors perform a post-accident monitoring function in accordance with RG 1.97. Also, the radiation monitor examines a sample from the atmospheric dump valve discharge for gamma dose rate and provides confirmatory indication of the atmospheric dump valve position during an SGTR.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.16-01 acceptable because the applicant identified both components and their intended functions. Therefore, the staff's concern described in RAI 2.3.4.16-01 is resolved.

2.3.4.16.3 Conclusion

The staff reviewed the LRA, FSAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the main steam system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.17 Relief Valve Vent System

2.3.4.17.1 Summary of Technical Information in the Application

The relief valve vent system routes relief device discharges to the atmosphere. Venting is provided for main steam safety valves, atmospheric dump valves, and high-pressure turbine reheat safety valves. The failure of nonsafety-related components in the relief valve vent system could prevent satisfactory accomplishment of a safety-related function.

LRA Section 2.3.4.17 describes the relief valve vent system. LRA Table 2.3.4-13 identifies the components subject to an AMR for the relief valve vent system by component type and intended function.

2.3.4.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.17 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.17.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the relief valve vent system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.18 Secondary Plant System

2.3.4.18.1 Summary of Technical Information in the Application

The secondary plant system provides instrumentation functions to measure temperatures, pressures, flows, and levels in the steam and auxiliary systems. The system monitors plant parameters in order to provide reliable inputs to the following control systems: (1) the EFIC system, (2) the ATWS system, (3) the non-nuclear instrumentation system, and (4) the integrated control system.

The secondary plant system typically consists of process variable sensors, signal processing equipment, and a means of selecting and or transmitting the derived signals for use by the plant. These signals are input to control and computer systems for monitoring and indication and to satisfy various functional requirements. The secondary plant system contains components that: (1) are safety-related and relied upon to remain functional during and following DBEs, (2) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function, and (3) perform functions that support fire protection, ATWS, EQ, and SBO.

LRA Section 2.3.4.18 describes the secondary plant system. LRA Table 2.3.4-14 identifies the components subject to an AMR for the secondary plant system by component type and intended function.

2.3.4.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.18 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff identified the secondary plant system in RAI 2.3-01, dated October 15, 2009, as one of the LRA systems with applicability to the staff's generic inquiry to the applicant's scoping and screening methodology for mechanical systems. The staff's evaluation and resolution to RAI 2.3-01 can be found in SER Section 2.3.

2.3.4.18.3 Conclusion

The staff reviewed the LRA, RAI responses, and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the secondary plant system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.19 Cycle Startup System

2.3.4.19.1 Summary of Technical Information in the Application

The cycle startup system is primarily designed to remove rust particles and oxidation products from the main feedwater system and to bring main feedwater system chemistry into specification before introducing feedwater to the OTSGs. The cycle startup system consists of three separate sections of piping and valves. The first section of the system connects downstream of the feedwater booster pumps, bypasses the MFPs, and reconnects upstream of the high-pressure feedwater heaters. The second section of the system connects downstream of the high-pressure feedwater heaters, bypasses the OTSGs, and can either provide a cleanup flow path (through the condensate demineralizers) or connect to the main condenser. The third section of the system connects auxiliary steam to the deaerator sparger nozzles. The cycle startup system also includes piping and valves credited with supporting operation of the main condenser in mitigation of the SGTR accident. The cycle startup system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

LRA Section 2.3.4.19 describes the cycle startup system. LRA Table 2.3.4-15 identifies the components subject to an AMR for the cycle startup system by component type and intended function.

2.3.4.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.19 and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.19.3 Conclusion

The staff reviewed the LRA and a license renewal drawing to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the cycle startup system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.20 Turbine Generator System

2.3.4.20.1 Summary of Technical Information in the Application

LRA Section 2.3.4.20 describes the turbine generator system, which converts thermal power in the main steam system and reheat steam system into electrical power leaving the main generator. The turbine generator system includes the high-pressure turbine, both low-pressure turbines, the main generator, the brushless exciter, and the Westinghouse voltage regulator. The system also includes the isolated phase bus duct. The turbine generator system contains components that: (1) are nonsafety-related whose failure could prevent satisfactory accomplishment of a safety-related function and (2) perform functions that support fire protection.

2.3.4.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.20 and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4.20.3 Conclusion

The staff reviewed the LRA and license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the turbine generator system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

This section documents the staff’s review of the applicant’s scoping and screening results for structures. Specifically, this section discusses the RB and other Class I and in-scope structures. In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs within the scope of license renewal and subject to an AMR. To verify that the applicant properly implemented its methodology, the staff’s review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of SCs that meet the scoping criteria and are subject to an AMR.

The staff's evaluation of the information in the LRA was the same for all structures. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for structures that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived SCs were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the FSAR, for each structure to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all intended functions delineated under 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified.

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine whether: (1) the functions are performed with moving parts or a change in configuration or properties or (2) the SCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

The staff reviewed LRA Section 2.4 (fire barrier portion only); FSAR; and license renewal drawings using the evaluation methodology described above and the guidance in the SRP-LR, Section 2.4. During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant had not omitted from the scope of license renewal any components with intended functions pursuant to Title 10 of the 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive or long-lived components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

The staff also reviewed the CR-3 fire protection CLB documents listed in the CR-3 Operating License Condition 2.C(9). This review included CR-3 commitments to 10 CFR 50.48, "Fire Protection" (i.e., approved fire protection program), as provided in the responses to Appendix A to the BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976, documented in the CR-3 SERs dated July 27, 1979; January 22, 1981; January 6, 1983; July 18, 1985; March 16, 1988; and October 29, 1997.

During its review of LRA Section 2.4 (fire barrier portion only), the staff identified areas in which additional information was necessary to complete its review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.4-1, dated August 31, 2009, the staff stated that LRA Section 2.4 appears to exclude several types of fire barrier components that appear in the SER, dated July 27, 1979. These fire components are listed below:

- LRA Table 2.4.1-1, fire doors, fire barrier penetration seals, and interior fire hose stations
- LRA Table 2.4.2-9, fire barrier assemblies, and interior fire hose stations

- LRA Table 2.4.2-10, fire barrier penetration seals, and interior fire hose stations
- LRA Table 2.4.2-12, fire barrier assemblies, fire doors, fire barrier penetration seals, and interior fire hose stations
- LRA Table 2.4.2-14, fire barrier assemblies, fire barrier penetration seals, and interior fire hose stations
- LRA Table 2.4.2-18, fire barrier assemblies

The staff requested that the applicant verify whether the above fire barrier assemblies and components are in the scope of license renewal in accordance with 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response, dated September 30, 2009, the applicant stated that:

- As identified in Table 2.4.1-1, there are no fire doors, fire door penetration seals or interior fire hose stations in the Reactor Building. There are fire barrier assemblies which include Thermo-Lag fire barriers on conduits, junction boxes, transmitters, and penetrations encapsulated by stainless steel as discussed in response to RAI 2.3.3.36-3.
- As identified in Table 2.4.2-9, there are no fire barrier assemblies or interior fire hose stations in the Diesel Generator Building.
- As identified in Table 2.4.2 10, there are no fire barrier penetration seals or interior fire hose stations in the EFW Pump Building.
- As identified in Table 2.4.2-12, the Fire Service Pumphouse contains no fire barrier assemblies, fire doors, fire barrier penetration seals, or interior fire hose stations.
- As identified in Table 2.4.2-14, the Machine Shop contains no fire barrier assemblies or fire barrier penetration seals. A fire hose station component was added to the Machine Shop based on the response to RAI 2.2-06. See CR3 to NRC letter, 3F0909-03, dated September 11, 2009, for the response to RAI 2.2-06.
- As identified in Table 2.4.2-18, there are no fire barrier assemblies in the Turbine Building.

The staff noted that LRA Section 2.3.3.36 defines fire barriers as concrete walls, floors, and ceilings and that fire barrier assemblies consist of Thermo-Lag and Mecatiss material.

In evaluating this response, the staff noted that the applicant used the term fire door penetration seals instead of fire barrier penetration seals. This resulted in the staff holding a telephone conference with the applicant on October 29, 2009, to discuss information necessary to resolve the concern in RAI 2.4-1. During the call, the applicant explained that it introduced a typo in the RAI response and that it will revise the response. In a letter dated December 3, 2009, the applicant revised the RAI response by deleting the word “door.” Based on the review, the staff finds the applicant’s response to the RAI acceptable because the applicant had addressed and resolved each item in the RAI, as discussed in the following paragraph.

The applicant confirmed that: (1) there are no fire doors, fire door penetration seals, or interior fire hose stations in the RB (LRA Table 2.4.1-1); (2) there are no fire barrier assemblies or interior fire hose stations in the diesel generator building (LRA Table 2.4.2-9); (3) there are no fire barrier penetration seals or interior fire hose stations in the EFW pump building (LRA Table 2.4.2-10); (4) there are no fire barrier assemblies, fire doors, fire barrier penetration seals, or interior fire hose station in the fire service pumphouse (LRA Table 2.4.2-12); (5) there are no fire barrier assemblies or fire barrier penetration seals in the machine shop; although, fire hose station components have been added in LRA Table 2.4.2-14; (6) there are no fire barrier assemblies in the TB (LRA Table 2.4.2-18).

Further, during review of the above response, the staff identified additional information regarding interior fire hose stations in the reactor and diesel generator buildings may be required. Therefore, by letter dated May 21, 2010, the staff issued additional RAIs and requested that the applicant verify whether interior hose stations are present in the RB in RAI 2.4-1.1 and in the diesel generator building in RAI 2.4-1.2 and if they are within the scope of license renewal in accordance with 10 CFR 54.4(a) and whether they are subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are excluded from the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated June 21, 2010, the applicant stated that there are no permanent hose stations within the RB. There is a fire service water system standpipe installed within the RB which provides fire service water for manual fire suppression. The system provides 2½-inch hose connections at eight locations. The RB standpipe system is within the scope of license renewal and subject to an AMR. The standpipe and standpipe hose connections are included in LRA Table 2.3.3-36 in the component/commodity group “Piping, piping components, standpipes, hydrants, and tanks,” and in LRA Table 3.3.2-36 with aging management by the External Services Monitoring, Boric Acid Corrosion, and Fire Water System programs. LRA Table 2.4.1-1 did not identify fire hose stations as a civil commodity because there are no cabinets, enclosures, houses, racks, or reels which support or provide protection for fire hoses.

For the diesel generator building, the applicant stated that there are no interior fire hoses installed. There are interior fire hose stations available in the AB. These fire hose stations are within the scope of license renewal as identified in LRA Table 2.4.2-1 and were subject to an AMR. The fire hose reels are age-managed by the Structures Monitoring Program and the Boric Acid Corrosion Control Program. The fire hose is considered a short-lived item that is replaced on condition and is not within the scope of license renewal.

Based on its review, the staff finds the applicant’s responses to RAIs 2.4-1, 2.4-1.1, and 2.4-1.2 acceptable because it clarified the staff’s concern regarding fire barriers, fire barrier penetration seals, fire barrier assemblies, fire doors, and interior fire hose stations. Therefore, the staff’s concern is resolved.

2.4.1 Reactor Building

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 describes the RB as a Class 1 concrete structure containing a prestressed cylindrical wall that has a post-tensioning system in the horizontal and vertical directions. The inside of the RB is lined with a carbon steel liner that is anchored to the concrete. The structure is supported on a flat foundation mat made of steel reinforced concrete which contains a recess to allow space for the containment sump. The RB has six buttresses equally spaced around the outside diameter of the structure that serve as anchorage for the horizontal tendons. Additionally, there is an access gallery on the underside of the foundation that provides access to the vertical tendons and is equipped with a drainage system. The structure has a prestressed shallow dome roof.

The RB also includes mechanical and electrical system penetrations, equipment hatch, and air locks. Internal concrete structures include the primary shield wall, beams, piers, pedestals, shield walls, hatch blocks, curbs, structural grout, and floors supported by structural steel. Additionally, the RB has passive physical crane structures within the scope of review, such as the main structural members, bridge, trolley, structural girders, rail system, base plates, retaining clips, fasteners, welds, and attachments to the structure.

The purpose of the RB is to house major plant equipment, such as the RCS, main steam, feedwater piping, and branch connections of the RCS.

LRA Table 2.4.1-1 identifies the components subject to an AMR for the RB by component type and intended function.

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.1.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SSCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RB SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2 Other Class I and In-Scope Structures

2.4.2.1 Auxiliary Building

2.4.2.1.1 Summary of Technical Information in the Application

LRA Section 2.4.2.1 describes the AB as a reinforced concrete structure that houses Class I components from elevation 95 feet to elevation 162 feet and a sheet metal enclosed structural steel superstructure from elevation 162 feet to elevation 209 feet. Additionally, the AB partially surrounds the RB and is protected from flooding by watertight doors and panels up to elevation 129 feet.

Also included in the AB are the nuclear service and decay heat sea water pumps, the new fuel racks and two spent fuel pools (spent fuel pool A and spent fuel pool B), a 120-ton fuel handling area crane, a 10-ton spent fuel pit missile shield crane, a spent fuel pool handling bridge crane, and various safety-related equipment and components.

LRA Table 2.4.2-1 identifies the components subject to an AMR for the AB by component type and intended function.

2.4.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.1 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

During its review of LRA Section 2.4.2.1, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the AB.

In RAI 2.4.2.1-1 dated September 22, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the watertight sleeves around the raw water sump vents that protect the AB at an elevation of 95 feet against flood levels up to an elevation of 129 feet, since they are not listed in LRA Table 2.4.2-1 as being within the scope of license renewal.

In its response dated October 22, 2009, the applicant stated that watertight sleeves around the raw water sump vents that protect the AB are within the scope of license renewal and subject to an AMR and are included in LRA Table 2.4.2-15, "Other Miscellaneous Structures," within the component/commodity group, "Platforms, Pipe Whip Restraints, Jet Impingement Shields, Masonry Wall Supports and Other Miscellaneous Structures." The intended functions listed for this entry in LRA Table 2.4.2-15 are "Missile Barrier, Flood Barrier, and Structural Support."

Based on its review, the staff finds the applicant's response to RAI 2.4.2.1-1 acceptable because the watertight sleeves around the raw water sump vents that protect the AB at an elevation of 95 feet against flood levels up to an elevation of 129 feet, that support the intended functions of the AB, have been designated as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.2.1-1 is resolved.

2.4.2.1.3 Conclusion

The staff reviewed the LRA, FSAR, and RAI response to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the AB SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.2 Wave Embankment Protection Structure

2.4.2.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2.2 describes the wave embankment protection structure (WEPS) as a unique earthen embankment treated as a stand-alone structure for license renewal purposes. It is physically located at the perimeter of the protected area and surrounds the Class I structures with some exceptions. The base of the embankment is at elevation 98 feet and rises to 118.5 feet at the top.

The WEPS is also equipped with a stepped profile and reinforced concrete design for protection against wave forces on the south and southwest sides of the protected area. Additionally, the structure is protected with un-reinforced concrete at the toe and top of the embankment in order to prevent undermining of the slope armor. The rest of the WEPS is covered with fiberglass matting that mitigates erosion of the structure.

LRA Table 2.4.2-2 identifies the components subject to an AMR for the WEPS by component type and intended function.

2.4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.2 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.2.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the WEPS SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.3 Borated Water Storage Tank Foundation and Shield Wall

2.4.2.3.1 Summary of Technical Information in the Application

LRA Section 2.4.2.3 describes the borated water storage tank foundation (BWSTF) and shield wall as reinforced concrete, Class IA structures. An attached structure containing two abandoned tanks, an HVAC system, and several other components are also included as part of the BWSTF and shield wall. The purpose of the BWSTF and shield wall is to provide missile protection for the BWST that rests on a portion of the AB roof.

LRA Table 2.4.2-3 identifies the components subject to an AMR for the BWSTF and shield wall by component type and intended function.

2.4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.3 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

During its review of LRA Section 2.4.2.3, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the BWSTF and shield wall, as discussed below.

In RAI 2.4.2.3-1 dated September 22, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the attached reinforced concrete structure that contains several components, such as abandoned tanks and a drain sump, since it is not clear if it was included in LRA Table 2.4.2-3 as being within the scope of license renewal and subsequently evaluated for an AMR.

In its response dated October 22, 2009, the applicant stated that the attached reinforced concrete structure that contains several components, such as abandoned tanks and a drain sump, are within the scope of license renewal and subject to an AMR.

The applicant also stated that the specific structural commodities/components for the attached structure include the reinforced concrete structure, anchorage/embedments for support steel and pipe supports, platform, supports for ventilation fan and duct work, pipe supports, and a door. Additionally, the applicant stated that during preparation of the RAI response, it was determined that the door to the attached structure is not a flood door since the flood door to the BWST access area is located in the concrete flood barrier wall, described in LRA Section 2.4.2.15, "Miscellaneous Structures."

Based on its review, the staff finds the applicant's response to RAI 2.4.2.3-1 acceptable because the attached reinforced concrete structure of the BWSTF and shield wall that contains several components, such as abandoned tanks and a drain sump, that support the intended functions of the BWSTF and shield wall, have been designated as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.2.3-1 is resolved.

In RAI 2.4.2.3-2 dated September 22, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the 1-inch thick STYROFOAM filler located in the gap between the concrete missile barrier and the side of the BWST, since it is not clear if it was included in LRA Table 2.4.2-3 as being within the scope of license renewal and subsequently evaluated for an AMR.

In its response dated October 22, 2009, the applicant stated that the 1-inch thick STYROFOAM filler located in the gap between the concrete missile barrier and the side of the BWST is not within the scope of license renewal since it does not perform any license renewal intended functions.

The applicant also stated that the filler is located in the gap between the tank liner plate and the wall around the BWST during construction. Additionally, the filler does not provide any protection or support function and since the maximum temperature reached by the BWST is 100 °F, no degradation due to temperature is expected. Also, no credit for freeze protection is given to the STYROFOAM since CR-3 uses proceduralized cold weather monitoring.

Based on its review, the staff finds the applicant's response to RAI 2.4.2.3-2 acceptable because the exclusion of the 1-inch thick STYROFOAM filler located in the gap between the concrete missile barrier and the side of the BWST has been justified. Therefore, the staff's concern described in RAI 2.4.2.3-2 is resolved.

In RAI 2.4.2.3-3 dated September 22, 2009, the staff requested that the applicant provide additional information to confirm if the Class I foundation of the BWST is completely above grade or else justify the exclusion of the below-grade concrete from LRA Table 2.4.2-3.

In its response dated October 22, 2009, the applicant stated that the Class I foundation of the BWST is completely above grade and was directly placed on the AB slab at 119 feet elevation.

Based on its review, the staff finds the applicant's response to RAI 2.4.2.3-3 acceptable because it was confirmed that the Class I foundation of the BWST is completely above grade. Concrete above grade has been included in LRA Table 2.4.2-3 as being within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.2.3-3 is resolved.

2.4.2.3.3 Conclusion

The staff reviewed the LRA, FSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the BWSTF and shield wall SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.4 Cable Bridge

2.4.2.4.1 Summary of Technical Information in the Application

LRA Section 2.4.2.4 describes the cable bridge as composed of two bridges east and west that span the discharge canal. The west bridge is physically located northwest of the protected area, downstream of the circulating water discharge structure and is supported at mid span with a submerged concrete pier. Based on the configuration of the cable tunnel, the concrete tunnel from CR-1 to the west cable bridge and from the cable bridge to the 230-kilovolt (kV) terminal house is included within the cable structure. The east bridge is located north of the protected area at the head of the discharge canal and is a steel structural truss whose end rests on concrete abutments. The purpose of the cable bridge is to provide support for electrical circuits required to mitigate a postulated SBO event.

LRA Table 2.4.2-4 identifies the components subject to an AMR for the cable bridge by component type and intended function.

2.4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.4 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

During its review of LRA Section 2.4.2.4, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the cable bridge.

In RAI 2.4.2.4-1 dated September 22, 2009, the staff requested that the applicant provide additional information to indicate if any seals, gaskets, or any other applicable flood barriers or insulation were used in the SBO conduits given their proximity to a body of water.

In its response dated October 22, 2009, the applicant stated that there are no seals, gaskets, or any other applicable flood barriers or insulation associated with safety or nonsafety-related cable bridges. The applicant also stated that the west cable bridge has conduits that are continuous and, therefore, do not have any seals.

Based on its review, the staff finds the applicant's response to RAI 2.4.2.4-1 acceptable because there are no additional seals, gaskets, or any other applicable flood barriers or insulation to be considered in the review that support the intended functions of the cable bridge structure. Therefore, the staff's concern described in RAI 2.4.2.4-1 is resolved.

In RAI 2.4.2.4-2 dated September 22, 2009, the staff requested that the applicant provide additional information to indicate if the HVAC ducts system component supports are included within the scope of license renewal or else justify the exclusion of the supports from LRA Table 2.3.2-4, since the aforementioned table lists the cable tray, conduit, HVAC ducts, and tube tracks as being within scope.

In its response dated October 22, 2009, the applicant stated that the cable bridge structure does not include HVAC ducts and tube tracks. The applicant also stated that the methodology used in the LRA involved a generic component/commodity group for "Cable Tray, Conduit, HVAC Ducts, Tube Track" throughout LRA Sections 2.4 and 3.5.

Based on its review, the staff finds the applicant's response to RAI 2.4.2.4-2 acceptable because there are no HVAC ducts system component supports that support the intended functions of the cable bridge structure. Therefore, the staff's concern described in RAI 2.4.2.4-2 is resolved.

2.4.2.4.3 Conclusion

The staff reviewed the LRA, FSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the cable bridge structure SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.5 Control Complex

2.4.2.5.1 Summary of Technical Information in the Application

LRA Section 2.4.2.5 describes the CC as a six floor concrete structure founded on a concrete fill overlaying cement-grouted lime rock. It has a concrete portion designed to resist tornado-generated missiles which houses Class I components. Additionally, the structure is physically surrounded by three buildings that are flood protected and the remaining side of the structure is also flood protected.

The purpose of the CC is to house the main control room and the safety-related equipment/components that control and operate the reactor and NSSS systems. It also houses the electrical switchgear, emergency batteries, battery chargers, and fire protection equipment.

LRA Table 2.4.2-5 identifies the components subject to an AMR for the CC by component type and intended function.

2.4.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.5 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.5.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the CC SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.6 Intake and Discharge Canals

2.4.2.6.1 Summary of Technical Information in the Application

LRA Section 2.4.2.6 describes the intake and discharge canals as earthen structures. The intake canal extends about 8 miles into the Gulf of Mexico and was subsequently extended eastward during construction of CR-3 to provide additional cooling. The portion of the intake canal included within scope is from the entrance at the mainland to the circulating water intake structure. The discharge canal is an open channel with a base width of 125 feet but does not support a license renewal intended function.

LRA Table 2.4.2-6 identifies the components subject to an AMR for the intake and discharge canals by component type and intended function.

2.4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.6 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.6.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the intake and discharge canal SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.7 Circulating Water Discharge Structure

2.4.2.7.1 Summary of Technical Information in the Application

LRA Section 2.4.2.7 describes the circulating water discharge structure as a U-shaped reinforced concrete structure. It is physically located north of the CR-3 protected area on the south side of the discharge canal. It is composed of the reinforced concrete nuclear service sea water discharge structure and the circulating water discharge structure. The circulating water discharge structure has four 8-foot diameter discharge lines entering the bulkhead wall and the flow is then subsequently discharged into the basin of the discharge structure. The nuclear service sea water discharge is a reinforced concrete structure that has two nuclear sea water lines that travel through the structure and discharge directly into the discharge canal. The purpose of the circulating water discharge structure is to maintain structural integrity in support of an SGTR event. The purpose of the nuclear service sea water discharge structure is to ensure that the nuclear service and decay heat sea water system lines remain open and are capable of discharging into the discharge canal.

LRA Table 2.4.2-7 identifies the components subject to an AMR for the circulating water discharge structure by component type and intended function.

2.4.2.7.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.7 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.7.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the circulating water discharge structure SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.8 Circulating Water Intake Structure

2.4.2.8.1 Summary of Technical Information in the Application

LRA Section 2.4.2.8 describes the circulating water intake structure as a reinforced concrete structure physically located south of the protected area. There is no active equipment necessary to maintain the plant in a safe condition located in the structure. Safety-related components included in the structure are the reinforced concrete structures associated with the nuclear service sea water intake conduits.

The purpose of the circulating water intake structure is to support the circulating water pumps, traveling screens, trash racks, intake gantry crane, and the Class I nuclear service sea water intake structure. Additionally, the structure is required in order to maintain structural integrity in support of an SGTR event.

LRA Table 2.4.2-8 identifies the components subject to an AMR for the circulating water intake structure by component type and intended function.

2.4.2.8.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.8 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

During its review of the LRA Section 2.4.2.8, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the circulating water intake structure.

In RAI 2.4.2.8-1 dated September 22, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the cut-off wall that extends into the caprock, which provides protection of the intake structure during a postulated probable maximum peak tide, from the scope of license renewal.

In its response dated October 22, 2009, the applicant stated that the cut-off wall that extends into the caprock, which provides protection of the intake structure during a postulated probable maximum peak tide, is within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.4.2.8-1 acceptable because the cut-off wall that extends into the caprock is included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.4.2.8-1 is resolved.

2.4.2.8.3 Conclusion

The staff reviewed the LRA, FSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SSCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the circulating water intake structure SSCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.9 Diesel Generator Building

2.4.2.9.1 Summary of Technical Information in the Application

LRA Section 2.4.2.9 describes the diesel generator building as a single story, reinforced concrete structure that is founded on structural concrete backfill overlying cement-grouted lime rock. It is physically located adjacent to the Class I AB on the west side and the Class III machine shop on the north side. The structure is designed for tornado-generated missiles and earthquakes. The structure has an air deflector designed to minimize the amount of exhaust air that can be recirculated to the air intake. This allows the engine to maintain its design performance. The purpose of the diesel generator building is to house and support the two standby diesel generators (A and B), their exhaust silencers, and various safety-related equipment and components.

LRA Table 2.4.2-9 identifies the components subject to an AMR for the diesel generator building by component type and intended function.

2.4.2.9.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.9 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.9.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the diesel generator building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.10 Emergency Feedwater Pump Building

2.4.2.10.1 Summary of Technical Information in the Application

LRA Section 2.4.2.10 describes the EFPB structure as a single story, reinforced concrete structure that has a reinforced concrete roof slab. It is founded on a wave step panel of the WEPS and suitable existing compacted fill. The structure is equipped with three flood protection doors that provide protection up to 135 feet. The purpose of the concrete structure of the EFPB is to house Class I components, such as a battery room, tank room, and the diesel pump room. Additionally, it houses a 3-ton crane.

LRA Table 2.4.2-10 identifies the components subject to an AMR for the EFPB by component type and intended function.

2.4.2.10.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.10 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.10.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the EFPB SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.11 Dedicated Emergency Feedwater Tank Enclosure Building

2.4.2.11.1 Summary of Technical Information in the Application

LRA Section 2.4.2.11 describes the dedicated EFW tank enclosure building as a single story, reinforced concrete building. It is a Class I structure that has a sloping roof. The structure is equipped with a watertight door that prevents flooding up to 129 feet. The purpose of the dedicated EFW tank enclosure building is to house the EFW tank and associated piping components.

LRA Table 2.4.2-11 identifies the components subject to an AMR for the dedicated EFW tank enclosure building by component type and intended function.

2.4.2.11.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.11 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.11.3 Conclusion

The staff followed the evaluation methodology discussed in Section 2.4 and reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the dedicated EFW tank enclosure building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.12 Fire Service Pumphouse

2.4.2.12.1 Summary of Technical Information in the Application

LRA Section 2.4.2.12 describes the fire service pumphouse as a single story, concrete masonry structure founded on a concrete mat foundation located on grade. The structure has a built-up membrane roof at approximately 131-foot elevation. The structure is physically separate from other structures but in close proximity to the RB and the IB. The purpose of the fire service pumphouse is to house three fire service pumps, two diesel-driven and one electric motor-driven, which provide operating pressure under system use. Additionally, there is a motor-driven pressure maintenance (jockey) pump.

LRA Table 2.4.2-12 identifies the components subject to an AMR for the fire service pumphouse by component type and intended function.

2.4.2.12.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.12 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.12.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the fire service pumphouse SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.13 Intermediate Building

2.4.2.13.1 Summary of Technical Information in the Application

LRA Section 2.4.2.13 describes the IB as a reinforced concrete structure which is partially founded on structural concrete backfill overlaying cement-grouted lime rock and the rest is founded on a concrete mat foundation located on compacted backfill. The building partially surrounds the RB and is physically located adjacent to the RB, CC, AB, TB, and fire service pumphouse. The purpose of the IB is to house Class I components, such as RB leak rate test equipment, a turbine driven pump, and a portion of the main steam lines. Also, the structure is designed for tornado-generated missiles.

LRA Table 2.4.2-13 identifies the components subject to an AMR for the IB by component type and intended function.

2.4.2.13.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.13 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.13.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the IB SSCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.14 Machine Shop

2.4.2.14.1 Summary of Technical Information in the Application

LRA Section 2.4.2.14 describes the machine shop as a Class III structure, two story structural steel, and sheet metal building. The machine shop structure is physically adjacent to the TB, CC, and AB on the west side, the diesel generator building on the south side, and the ready warehouse on the east side. The purpose of the machine shop is to contain components required to support regulated events associated with fire protection, such as an Appendix R chiller that is supported on the roof.

LRA Table 2.4.2-14 identifies the components subject to an AMR for the machine shop by component type and intended function.

2.4.2.14.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.14 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.14.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the machine shop SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.15 Miscellaneous Structures

2.4.2.15.1 Summary of Technical Information in the Application

LRA Section 2.4.2.15 describes the miscellaneous structures as stand-alone structures that are not part of major building systems. The miscellaneous structures include:

<u>Condensate Storage Tank Foundation</u>. This is described as a seismic one reinforced concrete mat foundation with oiled sand under the bottom. It is adjacent to the west side of the TB.

<u>Hydrazine Addition Tank Foundation</u>. This is a small tank, supported by four legs anchored to a concrete foundation. It is physically located outside the TB, adjacent to the condensate storage tank.

Fire Service Water Tank Foundations. These are described as reinforced concrete ring foundations with oiled sand under the tank bottom. They are categorized as Class III structures.

Buried Fuel Oil Tank Foundation and Vent Pipes. There are two tanks that provide fuel for the EDGs, which are supported on concrete saddles.

Manholes and Duct Banks. Manholes are typically constructed of reinforced concrete, located below grade and covered. Duct banks usually consist of electrical conduits surrounded by concrete and are below grade. Manholes within scope include the following:

- plant outside areas: E1, E2, E3
- hot machine shop: E7
- discharge canal (cable bridge, east): SB1, SB2

Concrete Flood Barriers. Barriers include concrete plugs, monorails, watertight doors, and elastomeric seals located at various locations around the plant.

Instrument Air Equipment Foundation. This is physically located in the northeast corner adjacent to the TB and main transformers. Components are supported on a concrete pad.

Fire Hose Stations. These are located around the perimeter of the CR-3 yard and contained in numbered sheet metal sheds.

Offsite Power Termination Enclosure. This is described as a small sheet metal structure located on the west side of the plant on the WEPS near the fire service water tanks structure. It is supported on a concrete foundation.

Fire Protection Header Supports. A portion of the piping is routed above ground on short concrete pedestals. Fire protection piping is credited as a license renewal fire protection function.

Transformer Enclosures. The transformer enclosures are associated with the unit auxiliary, startup, and backup ES transformers. The enclosures include the concrete flame impingement walls between transformers, as well as the foundations.

Miscellaneous Pipe Supports. The following systems are included in the commodity:

- auxiliary steam
- condensate
- fuel oil
- decay heat removal
- domestic water
- emergency feedwater
- fire protection

- instrument air
- leak rate test
- station air
- station drains
- reactor building airlock
- nuclear service and decay heat sea water

LRA Table 2.4.2-15 identifies the components subject to an AMR for the miscellaneous structures by component type and intended function.

2.4.2.15.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.15 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.15.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the miscellaneous structures SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.16 Switchyard for Crystal River Site

2.4.2.16.1 Summary of Technical Information in the Application

LRA Section 2.4.2.16 describes the switchyard for the Crystal River site as a Class II structure. Some of the components located within are SBO components and have been provided with concrete foundations. It is physically located approximately 300 yards north of the protected area. The switchyard also has a switchyard relay building and a terminal house. The purpose of the switchyard is to connect the power generated by CR-3 to the Progress Energy system for distribution. Additionally, the switchyard for the Crystal River site provides a reliable source of offsite power when recovering from an SBO event.

LRA Table 2.4.2-16 identifies the components subject to an AMR for the switchyard for the Crystal River site by component type and intended function.

2.4.2.16.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.16 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.16.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the switchyard for the Crystal River site SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.17 Switchyard Relay Building

2.4.2.17.1 Summary of Technical Information in the Application

LRA Section 2.4.2.17 describes the switchyard relay building as consisting of the 500-kV switchyard relay building, 230-kV terminal house, and the 500-kV terminal house. The 230-kV terminal house contains the DC power distribution panels for breakers 1691 and 1692 that are required for recovering from an SBO event. The 500-kV switchyard relay building contains the DC power distribution panel for plant line breakers 4900 and 4902 that are credited for restoration of offsite power when recovering from an SBO event. The purpose of the switchyard relay building is to provide power and controls for components in the switchyard.

LRA Table 2.4.2-17 identifies the components subject to an AMR for the switchyard relay building by component type and intended function.

2.4.2.17.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.17 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.17.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the switchyard relay building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.18 Turbine Building

2.4.2.18.1 Summary of Technical Information in the Application

LRA Section 2.4.2.18 describes the TB as a structural steel superstructure founded on a reinforced concrete mat on concrete fill, overlaying cement-grouted lime rock. The TB external walls are a combination of concrete or sheet metal siding. The structure is physically adjacent to the IB and the CC. The purpose of the TB is to house the turbines.

LRA Table 2.4.2-18 identifies the components subject to an AMR for the TB by component type and intended function.

2.4.2.18.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.18 and the FSAR using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. During its review, the staff evaluated the structural component functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.18.3 Conclusion

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the TB SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Control Systems

This section documents the staff's review of the applicant's scoping and screening results for electrical and I&C systems.

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs within the scope of license renewal and subject to an AMR. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of electrical and I&C system components that meet the scoping criteria and are subject to an AMR.

The staff's evaluation of the information in the LRA was the same for all electrical and I&C systems. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for electrical and I&C systems that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed the FSAR for each electrical and I&C system to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a).

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SSCs with intended functions, the staff sought to determine whether the functions are performed with moving parts or a change in configuration or properties, or the SSCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SSCs were subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.1 Electrical and Instrumentation and Control Component Commodity Groups

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5 describes the electrical and I&C systems. The scoping method includes all plant electrical and I&C components. Evaluation of electrical systems includes electrical and I&C components in mechanical systems. The plant-wide basis approach for the review of plant equipment eliminates the need to indicate each unique component and its specific location and precludes improper exclusion of components from an AMR.

The electrical and I&C components that were identified to be within the scope of license renewal have been grouped by the applicant into component commodity groups. The applicant applied the screening criteria in 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) to this list of component commodity groups to identify those that perform their intended functions without moving parts or without a change in configuration or properties, and to remove the component commodity groups that are subject to replacement based on a qualified life or specified time period. The following list identifies the component commodity groups that are subject to an AMR and their intended functions:

- non-EQ insulated cables and connections (connections include splices, connectors, fuse holders, and terminal blocks) – function of electrical continuity
- electrical portions of non-EQ electrical/I&C penetration assemblies (penetration assemblies include electrical penetration assemblies and conduit seal assemblies) – function of electrical continuity
- metal-enclosed bus and connections – function of electrical continuity, insulation, and protection
- high-voltage insulators – function of insulation

- switchyard bus and connections – function of electrical continuity
- transmission conductors and connections – function of electrical continuity

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5 and FSAR Sections 7 and 8 using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems."

During its review, the staff evaluated the system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

General Design Criteria 17 of 10 CFR Part 50, Appendix A requires that electric power from the transmission network, to the onsite electric distribution system, be supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance provided by letter dated April 1, 2002, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," states:

> For purposes of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule. This path typically includes switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical system, and the associated control circuits and structures. Ensuring that the appropriate offsite power system long-lived passive SSCs that are part of this circuit path are subject to an AMR will assure that the bases underlying the SBO requirements are maintained over the period of extended license.

The applicant included the complete circuits between the onsite circuits and up to, and including, switchyard breakers (which includes the associated controls and structures) supplying the offsite power transformer (OPT) and the backup engineered safeguards transformer (BEST) within the scope of license renewal. Both OPT and BEST supply the 4,160 V and 480 V buses. The first source of offsite power is fed from the Progress Energy transmission and distribution system and received through two 230-kV circuit breakers (4900 and 4902) which supply the OPT. These breakers are the scoping boundary for the first source of offsite power. The second source of offsite power is fed from the Progress Energy transmission and distribution system and received through two 230-kV circuit breakers (1691 and 1692) which supply the BEST. These breakers are the scoping boundary for the second source of offsite power. Consequently, the staff determined that the scoping is consistent with the guidance issued on April 1, 2002, and later incorporated in SRP-LR Section 2.5.2.1.1.

The applicant has not included cable tie-wraps in any component commodity group. In the LRA, the applicant stated that a review was performed to determine if cable tie-wraps meet the scoping criteria of 10 CFR 54.4. The applicant stated that cable tie-wraps are used during cable installation to keep cables neat and organized but they do not function as cable supports, and seismic qualification of cable trays does not credit the use of electrical cable tie-wraps. Furthermore, the applicant has considered the failure of plastic cable tie-wraps and concluded that such failure would not affect safety-related equipment. The applicant reviewed its operating experience which shows that failure of cable tie-wraps has not affected any equipment at CR-3. Based on its review, the staff finds the applicant's exclusion of cable tie-wraps from the SSCs subject to an AMR, acceptable.

2.5.1.3 Conclusion

The staff reviewed the LRA and the FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found no such omissions. In addition, the staff determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the electrical and I&C systems components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

The staff reviewed the information in LRA Section 2, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results," and determines that the applicant's scoping and screening methodology was consistent with 10 CFR 54.21(a)(1), and the staff's position on the treatment of safety-related and nonsafety-related SSCs within the scope of license renewal and on SCs subject to an AMR is that it is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

On the basis of its review, the staff concludes the applicant has adequately identified those systems and components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

The staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses in accordance with the CLB and any changes to the CLB in order to comply with 10 CFR 54.21(a)(1), in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Crystal River Unit 3 Nuclear Generating Plant (CR-3), by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff). In Appendix B of its license renewal application (LRA), Florida Power Corporation (FPC or the applicant) described the AMPs that it relies on to manage or monitor the aging of passive, long-lived structures and components (SCs).

In LRA Section 3, the applicant provided the results of the AMRs for those SCs identified in LRA Section 2 as within the scope of license renewal and subject to an AMR.

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

In preparing its LRA, the applicant credited NUREG-1801, Revision 1, "Generic Aging Lessons Learned (GALL) Report," dated September 2005. The GALL Report contains the staff's generic evaluation of the existing plant programs and documents the technical basis for determining where existing programs are adequate without modification and where existing programs should be augmented for the period of extended operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular license renewal SCs. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL Report in its LRA to demonstrate that its programs correspond to those reviewed and approved in the report.

The purpose of the GALL Report is to provide a summary of staff-approved AMPs to manage or monitor the aging of SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for LRA review will be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report also serves as a quick reference for applicants and staff reviewers to AMPs and activities that the staff has determined will adequately manage or monitor aging during the period of extended operation.

The GALL Report identifies: (1) systems, structures, and components (SSCs); (2) SC materials; (3) environments to which the SCs are exposed; (4) the aging effects of the materials and environments; (5) the AMPs credited with managing or monitoring the aging effects; and (6) recommendations for further applicant evaluations of aging management for certain component types.

To determine whether use of the GALL Report would improve the efficiency of LRA review, the staff conducted a demonstration of the GALL Report process in order to model the format and content of safety evaluations (SEs) based on it. The results of the demonstration project confirmed that the GALL Report process will improve the efficiency and effectiveness of LRA review while maintaining the staff's focus on public health and safety. NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear

Power Plants" (SRP-LR), dated September 2005, was prepared based on both the GALL Report model and lessons learned from the demonstration project.

The staff's review was in accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and the guidance of the SRP-LR and the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of AMPs, during the week of July 13, 2009. The onsite audit and review is designed for maximum efficiency of the staff's LRA review. The applicant can respond to questions, the staff can readily evaluate the applicant's responses, the need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in review efficiency.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that follows the standard LRA format agreed to by the staff and the Nuclear Energy Institute (NEI) by letter dated April 7, 2003 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML030990052). This revised LRA format incorporates lessons learned from the staff's reviews of the previous five LRAs, which used a format developed from information gained during a staff-NEI demonstration project conducted to evaluate the use of the GALL Report in the LRA review process.

The organization of LRA Section 3 parallels that of SRP-LR Chapter 3. LRA Section 3 presents AMR results information in the following two table types:

(1) Table 1s: Table 3.x.1 – where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, and "1" indicates that this table type is the first in LRA Section 3.

(2) Table 2s: Table 3.x.2-y – where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, "2" indicates that this table type is the second in LRA Section 3, and "y" indicates the system table number.

The content of the previous LRAs and of the CR-3 application is essentially the same. The intent of the revised format of the CR-3 LRA was to modify the tables in LRA Section 3 to provide additional information that would assist in the staff's review. In its Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

Each Table 1 compares in summary how the facility aligns with the corresponding tables in the GALL Report. The tables are essentially the same as Tables 1 through 6 in the GALL Report, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column is a means for the staff reviewer to cross-reference Table 2s with Table 1s. In the "Discussion" column, the applicant provided clarifying information.

The following are examples of information that might be contained within this column:

- further evaluation recommended – information or reference to where that information is located
- the name of a plant-specific program
- exceptions to the GALL Report assumptions
- discussion of how the line is consistent with the corresponding line item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding line item in the GALL Report (e.g., when an exception is taken to a GALL Report AMP)

The format of each Table 1 allows the staff to align a specific row in the table with the corresponding GALL Report table row so that the consistency can be easily checked.

3.0.1.2 Overview of Table 2s

Each Table 2 provides the detailed results of the AMRs for components identified in LRA Section 2 as subject to an AMR. The LRA has a Table 2 for each of the systems or structures within a specific system grouping (e.g., reactor coolant system (RCS), engineered safety features (ESF), auxiliary systems, etc.). For example, the ESF group has tables specific to the containment spray system, containment isolation system, and emergency core cooling system (ECCS). Each Table 2 consists of nine columns:

(1) Component Type – The first column lists LRA Section 2 component types subject to an AMR in alphabetical order.

(2) Intended Function – The second column identifies the license renewal intended functions, including abbreviations, where applicable, for the listed component types. Definitions and abbreviations of intended functions are in LRA Table 2.0-1.

(3) Material – The third column lists the particular construction material(s) for the component type.

(4) Environment – The fourth column lists the environments to which the component types are exposed. Internal and external service environments are indicated with a list of these environments in LRA Table 3.0-1.

(5) Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERMs). As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.

(6) Aging Management Programs – The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.

(7) NUREG-1801 Volume 2 Item – The seventh column lists the GALL Report item(s) identified in the LRA as similar to the AMR results. The applicant compared each combination of component type, material, environment, AERM, and AMP in LRA Table 2 with the GALL Report items. If there are no corresponding items in the GALL

Report, the applicant leaves the column blank in order to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

(8) Table 1 Item – The eighth column lists the corresponding summary item number from LRA Table 1. If the applicant identifies in each LRA Table 2 AMR results consistent with the GALL Report, the Table 1 line item summary number should be listed in LRA Table 2. If there is no corresponding item in the GALL Report, column eight is left blank. In this manner, the information from the two tables can be correlated.

(9) Notes – The ninth column lists the corresponding notes used to identify how the information in each Table 2 aligns with the information in the GALL Report. The notes, identified by letters, were developed by an NEI work group and will be used in future LRAs. Any plant-specific notes identified by numbers provide additional information about the consistency of the line item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted three types of evaluations of the AMRs and AMPs:

(1) For items that the applicant stated were consistent with the GALL Report, the staff conducted either an audit or a technical review to determine consistency.

(2) For items that the applicant stated were consistent with the GALL Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of the item to determine consistency. In addition, the staff conducted either an audit or a technical review of the applicant's technical justifications for the exceptions or the adequacy of the enhancements.

The SRP-LR states that an applicant may take one or more exceptions to specific GALL Report AMP elements; however, any deviation from or exception to the GALL Report AMP should be described and justified. Therefore, the staff considers exceptions as being portions of the GALL Report AMP that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not meet all the program elements defined in the GALL Report AMP. However, the applicant may make a commitment to augment the existing program to satisfy the GALL Report AMP prior to the period of extended operation. Therefore, the staff considers these augmentations or additions to be enhancements. Enhancements include, but are not limited to, activities needed to ensure consistency with the GALL Report recommendations. Enhancements may expand, but not reduce, the scope of an AMP.

(3) For other items, the staff conducted a technical review to verify conformance with 10 CFR 54.21(a)(3) requirements.

Staff audits and technical reviews of the applicant's AMPs and AMRs determine whether the aging effects on SCs can be adequately managed to maintain their intended function(s) consistent with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For the AMPs for which the applicant claimed consistency with the GALL Report AMPs, the staff conducted either an audit or a technical review to verify the claim. For each AMP with one or more exception or enhancement, the staff evaluated each one to determine whether it is acceptable and whether the AMP will adequately manage the aging effect(s) for which it was credited. For AMPs not evaluated in the GALL Report, the staff performed a full review to determine their adequacy. The staff evaluated the AMPs against the following 10 program elements defined in SRP-LR Appendix A.

(1) Scope of the Program – Scope of the program should include the specific SCs subject to an AMR for license renewal.

(2) Preventive Actions – Preventive actions should prevent or mitigate aging degradation.

(3) Parameters Monitored or Inspected – Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended function(s).

(4) Detection of Aging Effects – Detection of aging effects should occur before there is a loss of structure or component intended function(s). This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new or one-time inspections to ensure timely detection of aging effects.

(5) Monitoring and Trending – Monitoring and trending should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) Acceptance Criteria – Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.

(7) Corrective Actions – Corrective actions, including root cause determination and prevention of recurrence, should be appropriate and timely.

(8) Confirmation Process – Confirmation process should ensure that preventive actions are adequate and that corrective actions have been completed and are effective.

(9) Administrative Controls – Administrative controls should provide for a formal review and approval process.

(10) Operating Experience – Operating experience of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation.

Details of the staff's audit evaluation of program elements (1) through (6) are documented in SER Section 3.0.3 for each AMP.

The staff reviewed the applicant's quality assurance (QA) program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the QA program included assessment of the "corrective actions," "confirmation process," and "administrative controls" program elements.

The staff reviewed the information on the “operating experience” program element and documented its evaluation in SER Section 3.0.3.

3.0.2.2 Review of AMR Results

Each LRA Table 2 contains information concerning whether or not the AMRs identified by the applicant align with the GALL Report AMRs. For a given AMR in a Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular system component type. Item numbers in column seven of the LRA, “NUREG-1801 Vol. 2 Item,” correlate to an AMR combination as identified in the GALL Report. The staff also conducted reviews to verify these correlations. A blank in column seven indicates that the applicant was unable to identify an appropriate correlation in the GALL Report. The staff also conducted a technical review of combinations not consistent with the GALL Report which are indicated in the LRA by generic notes F through J. The next column, “Table 1 Item,” refers to a number indicating the correlating row in Table 1.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff’s review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff reviewed those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff reviewed these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff reviewed these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant’s AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find the component in the applicable system in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff reviewed these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff reviewed these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff reviewed these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

3.0.2.3 FSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the final safety analysis report (FSAR) supplement, which summarizes the applicant's programs and activities for managing aging effects for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In its review, the staff used the LRA, LRA supplements, the SRP-LR, and the GALL Report. During the onsite audit, the staff also examined the applicant's justifications to verify that the applicant's activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management. Details of the staff's audit are documented in its audit report (ADAMS Accession No. ML093200023).

3.0.3 Aging Management Programs

SER Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the the GALL Report AMP with which the applicant claimed consistency and shows the section of this SER in which the staff's evaluation of the program is documented.

Table 3.0.3-1 Aging Management Programs

AMP	LRA Section(s)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	Staff's SER Section
ASME (American Society of Mechanical Engineers) Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	A.1.1.1 B.2.1	Existing	Consistent with exception	XI.M1	3.0.3.1.1
Water Chemistry Program	A.1.1.2 B.2.2	Existing	Consistent	XI.M2	3.0.3.1.2
Reactor Head Closure Studs Program	A.1.1.3 B.2.3	Existing	Consistent with enhancement	XI.M3	3.0.3.2.1
Boric Acid Corrosion Program	A.1.1.4 B.2.4	Existing	Consistent	XI.M10	3.0.3.1.3

AMP	LRA Section(s)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	Staff's SER Section
Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program	A.1.1.5 B.2.5	Existing	Consistent	XI.M11A	3.0.3.1.4
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program	A.1.1.6 B.2.6	New	Consistent	XI.M13	3.0.3.1.5
Flow-Accelerated Corrosion Program	A.1.1.7 B.2.7	Existing	Consistent	XI.M17	3.0.3.1.6
Bolting Integrity Program	A.1.1.8 B.2.8	Existing	Consistent with enhancement	XI.M18	3.0.3.2.2
Steam Generator Tube Integrity Program	A.1.1.9 B.2.9	Existing	Consistent with enhancement	XI.M19	3.0.3.1.7
Open-Cycle Cooling Water System Program	A.1.1.10 B.2.10	Existing	Consistent with enhancement	XI.M20	3.0.3.2.3
Closed-Cycle Cooling Water System Program	A.1.1.11 B.2.11	Existing	Consistent with exceptions and enhancement	XI.M21	3.0.3.2.4
Inspection of Overhead Heavy Load and Light Load Handling Systems Program	A.1.1.12 B.2.12	Existing	Consistent with enhancement	XI.M23	3.0.3.2.5
Fire Protection Program	A.1.1.13 B.2.13	Existing	Consistent with exceptions and enhancement	XI.M26	3.0.3.2.6
Fire Water System Program	A.1.1.14 B.2.14	Existing	Consistent with enhancement	XI.M27	3.0.3.2.7
Aboveground Steel Tanks Program	A.1.1.15 B.2.15	New	Consistent	XI.M29	3.0.3.1.8
Fuel Oil Chemistry Program	A.1.1.16 B.2.16	Existing	Consistent with exceptions and enhancement	XI.M30	3.0.3.2.8
Reactor Vessel Surveillance Program	A.1.1.17 B.2.17	Existing	Consistent with exception and enhancement	XI.M31	3.0.3.2.9
One-Time Inspection Program	A.1.1.18 B.2.18	New	Consistent	XI.M32	3.0.3.1.9
Selective Leaching of Materials Program	A.1.1.19 B.2.19	New	Consistent with exception	XI.M33	3.0.3.2.10
Buried Piping and Tanks Inspection Program	A.1.1.20 B.2.20	New	Consistent	XI.M34	3.0.3.1.10
Compressed Air Monitoring Program	A.1.1.21 B.2.21	Existing	Consistent	XI.M24	3.0.3.1.11
External Surfaces Monitoring Program	A.1.1.22 B.2.22	Existing	Consistent with exceptions and enhancement	XI.M36	3.0.3.2.11
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	A.1.1.23 B.2.23	New	Consistent with exception	XI.M38	3.0.3.1.12

AMP	LRA Section(s)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	Staff's SER Section
Lubricating Oil Analysis Program	A.1.1.24 B.2.24	Existing	Consistent with exception	XI.M39	3.0.3.2.12
ASME Section XI, Subsection IWE Program	A.1.1.25 B.2.25	Existing	Consistent	XI.S1	3.0.3.1.13
ASME Section XI, Subsection IWL Program	A.1.1.26 B.2.26	Existing	Consistent	XI.S2	3.0.3.1.14
ASME Section XI, Subsection IWF Program	A.1.1.27 B.2.27	Existing	Consistent	XI.S3	3.0.3.1.15
10 CFR Part 50, Appendix J Program	A.1.1.28 B.2.28	Existing	Consistent	XI.S4	3.0.3.1.16
Masonry Wall Program	A.1.1.29 B.2.29	Existing	Consistent with enhancement	XI.S5	3.0.3.2.13
Structures Monitoring Program	A.1.1.30 B.2.30	Existing	Consistent with enhancement	XI.S6	3.0.3.2.14
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	A.1.1.31 B.2.31	New	Consistent	XI.E1	3.0.3.1.17
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program	A.1.1.32 B.2.32	New	Consistent	XI.E2	3.0.3.1.18
Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	A.1.1.33 B.2.33	New	Consistent	XI.E3	3.0.3.1.19
Metal Enclosed Bus Program	A.1.1.34 B.2.34	New	Consistent	XI.E4	3.0.3.1.20
Fuse Holder Program	A.1.1.35 B.2.35	New	Consistent with exception	XI.E5	3.0.3.2.15
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program	A.1.1.36 B.2.36	New	Consistent with exceptions	XI.E6	3.0.3.2.16
Reactor Coolant Pressure Boundary Fatigue Monitoring Program	A.1.1.39 B.3.1	Existing	Consistent	X.M1	3.0.3.1.21
Environmental Qualification (EQ) Program	A.1.1.40 B.3.2	Existing	Consistent	X.E1	3.0.3.1.22
Fuel Pool Rack Neutron Absorber Monitoring Program	A.1.1.37 B.2.37	NA	Plant-specific	None	3.0.3.3.1
High-Voltage Insulators in the 230-kV Switchyard Program	A.1.1.38 B.2.38	NA	Plant-specific	None	3.0.3.3.2
One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program	Deleted	Deleted	Deleted	Deleted	3.0.3.1.23

3.0.3.1 AMPs Consistent with the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as consistent with the GALL Report:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Water Chemistry Program
- Boric Acid Corrosion Program
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Flow-Accelerated Corrosion Program
- Steam Generator Tube Integrity Program
- Aboveground Steel Tanks Program
- One-Time Inspection Program
- Buried Piping and Tanks Inspection Program
- Compressed Air Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- ASME Section XI, Subsection IWE Program
- ASME Section XI, Subsection IWL Program
- ASME Section XI, Subsection IWF Program
- 10 CFR Part 50, Appendix J Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Metal Enclosed Bus Program
- Reactor Coolant Pressure Boundary Fatigue Monitoring Program

- Environmental Qualification (EQ) Program

- One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program

3.0.3.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program

Summary of Technical Information in the Application. LRA Section B.2.1 describes the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant stated that the program consists of periodic volumetric, surface, and/or visual examination and leakage testing of Class 1, 2, and 3 pressure retaining components and their integral attachments to detect degradation of components and determine appropriate corrective actions.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M1, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of a request for additional information (RAI).

The staff noted that the "detection of aging effects" program element in GALL AMP XI.M1 states that the ASME Code Section XI Table IWB-2500-1 is used to determine the examination of Categories B-F and B-J welds. The staff noted that the applicant is using its approved relief requests for the current 10-year interval which includes an alternative to use a risk-informed methodology in lieu of the ASME Code Section XI, Categories B-F and B-J. The staff noted that the applicant does not treat this as an exception to the GALL AMP XI.M1 and that the approval of the risk-informed methodology cannot be assumed for the subsequent intervals. By letter dated September 11, 2009, the staff issued RAI B.2.1-1 requesting that the applicant clarify how the inspection of Categories B-F and B-J will be implemented during the period of extended operation.

In its response dated October 13, 2009, the applicant stated that it will comply with 10 CFR 50.55a for the period of extended operation as required by the plant's operating license, including requirements for implementing ASME Code Section XI, Subsections IWB, IWC, and IWD inspections. The staff noted that the applicant will remain in full compliance with the requirements of 10 CFR 50.55a for each additional 10-year inservice inspection (ISI) interval. The staff also noted that should the applicant intend to continue the alternative ASME Code Section XI, Category RA inspections during the period of extended operation, the applicant will have to submit a relief request, otherwise the applicant's program will include the ASME Code IWB-2500-1 Categories B-F and B-J welds. The staff further noted that since the request for an alternative is not assumed for the period of extended operation, and that the applicant plans to apply the ASME Code IWB-2500-1 Categories B-F and B-J, it is, therefore, consistent with the recommendations of GALL AMP XI.M1.

Based on its review, the staff finds the applicant's response to RAI B.2.1-1 acceptable because the applicant will comply with the requirements of 10 CFR 50.55a for the period of extended operation and that this relief request does not extend to subsequent 10-year ISI intervals.

Exception. In a letter dated March 3, 2010, the applicant updated the program with an exception to include aging management of ASME Code Class 1 small-bore piping, in response to RAI B.2.21-3. The applicant also deleted its One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program because this program is no longer applicable. This RAI response is described and evaluated in SER Section 3.0.3.1.23.

Instead of a plant-specific program, the applicant revised its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to include an exception to manage the small-bore piping. The staff reviewed this exception to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and finds that the program elements are consistent with the GALL Report recommendations except for the "detection of aging effects" and "monitoring and trending" program elements.

The applicant also revised its previous response regarding inspection technique for its Class 1 socket welds. The applicant stated that it will perform periodic volumetric examinations of Class 1 socket welds. The applicant further stated that the examination "will begin at such a time as an acceptable nuclear industry methodology for nondestructive socket weld examination becomes available." However, the applicant did not clearly identify when "such a time" would be, nor did the applicant describe the details of "an acceptable nuclear industry methodology."

Based on its review, the staff found the applicant's response to RAI B.2.21-3 unacceptable because the response did not provide assurance that a volumetric examination on socket welds will be performed. By letter dated July 8, 2010, the staff issued RAI B.2.21-4 requesting detailed information on the committed inspection schedule and methodology of volumetric examinations on socket welds.

In its response dated August 9, 2010, the applicant stated that, "[I]n the event a fully qualified technique for nondestructive examination is not available and an opportunistic inspection cannot be completed prior to the end of the 5th ISI Interval, CR-3 will develop a plant-specific volumetric examination [procedure] and perform an inspection prior to the end of the 5th ISI Interval." The staff noted that "fully qualified" (i.e., Performance Demonstration Initiative (PDI) qualified) ultrasonic testing (UT) technique would accurately size a flaw, but may be difficult to develop. The staff further noted that several demonstrated UT techniques have been developed and used by the nuclear industry. They provide a go/no go result that would be adequate in the examination of socket welds. Nonetheless, the applicant has committed to develop a plant-specific volumetric examination that is capable of detecting cracking in socket welds. Since it is consistent with the recommendation of GALL AMP XI.M35, the volumetric technique aspect of the issue is resolved. However, in regard to the timing of the first inspection, the staff is unclear of the basis for waiting until potentially the end of the fifth ISI interval for "a fully qualified" technique. The staff noted that the first inspection should be completed prior to the period of extended operation in order to obtain additional information on the baseline conditions in Class 1 socket welds and to provide reasonable assurance that cracking is not occurring prior to entering the period of extended operation. The staff noted that the demonstrated technique may be a viable technique until a fully qualified procedure is developed. By letter dated October 14, 2010, the staff issued RAI B.2.21-5 requesting justification on how the proposed inspection schedule for socket welds (i.e., commencing inspection of socket welds during, and potentially as late as the end of, the fifth ISI interval) will adequately manage the effects of aging in these components such that they will be able to perform their intended function during the period of extended operation.

Regarding inspection sample size, the applicant's August 9, 2010 response to RAI B.2.21-4 stated that, "[T]he total number of socket welds selected for examination will be at least 10 percent of the total population per [ten year ISI] interval." However, it further stated that "a destructive examination may be performed in lieu of the specified nondestructive examination." It was not clear to the staff the number of welds that are included in Commitment No. 16 should the applicant choose to perform a destructive examination. By letter dated October 14, 2010, the staff issued RAI B.2.21-5 requesting justification on how the potential option of a destructive examination of a socket weld will adequately manage the effects of aging in these components such that they will be able to perform their intended function during the period of extended operation.

In its response to RAI B.2.21-5, dated November 12, 2010, the applicant stated that "Prior to the period of extended operation, CR-3 will perform a baseline inspection equivalent to ⅓ of those inspections required for an interval. CR-3 will develop a volumetric examination technique capable of detecting cracking in Class 1 socket welds to support the revised implementation schedule." The staff noted that in addition to the inspection of ten percent of the welds during each ten-year interval of the period of extended operation, the applicant committed (Commitment No. 16) to performing a baseline inspection equivalent to ⅓ of the inspections required for an interval which is approximately 3.33 percent of its weld population. The staff noted that the additional inspection prior to the start of the period of extended operation will provide additional information on the baseline and the condition of the subject welds prior to the inspections during the period of extended operation which will include ten percent of the socket welds. The staff finds that the inspection schedule issue has been adequately addressed.

The applicant also stated in its November 12, 2010, response that "CR-3 will implement its previously proposed inspection schedule of 10 percent of the total population per interval… CR-3 will develop a volumetric examination technique capable of detecting cracking in Class 1 socket welds to support the revised implementation schedule… Volumetric examination techniques capable of detecting cracking in Class 1 socket welds may be either destructive or non-destructive. Substitution of a destructive examination for a non-destructive examination will be on a one-to-one basis."

The staff noted that the number of weld to be inspected and the weld selection methodology is consistent with the staff's position on sampling guidance, and is consistent with the recommendations in the GALL Report. In addition, the applicant has indicated that it has an option of performing opportunistic destructive examination in lieu of volumetric examination on a one-for-one basis. Based on the staff's sampling guidance, an applicant may take credit for each weld destructively examined equivalent to having volumetrically examined two welds because more information can be obtained from a destructive examination than from nondestructive examination. The staff finds that the proposed one-to-one is more than adequate because more information is obtained from a destructive examination than from nondestructive examination and is therefore, acceptable. The sampling adequacy issue regarding opportunistic destructive examination has been addressed. Since the number of welds to be inspected and the selection methodology, which will include the most risk significant and most susceptible welds, is consistent with the recommendations in the GALL Report the staff finds that aging management of Class 1 socket welds is adequately addressed and finds this exception acceptable, as described above.

Based on its audit and review of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and RAI responses, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the exception associated with "detection of aging effects" and "monitoring and trending" program elements, and their justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.1 summarizes operating experience related to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff noted that the applicant's review includes its outage examination results during the fourth 10-year ISI interval and the applicant stated that its program activities have been satisfactorily performed.

The staff reviewed the applicant's program basis document for safety significant operating experience relevant to the aging management of ASME Code Class 1, 2, and 3 components. The staff reviewed samples of the applicant's ISI examination results and the implementation of its ASME Code repair/replacement. The staff noted that the applicant has relevant operating experience for the ISI program and had taken corrective actions for flaw indications by performing repairs/replacements of the components. The staff also identified from the applicant operating experience that it has experienced cracking in its Class 1 small-bore piping. The staff noted that the experience warranted periodic inspections of its small-bore piping (e.g., less than 4 inch nominal pipe size). The staff noted that the GALL Report recommends periodic inspection of small-bore piping if an applicant has experienced failures. In response to RAI B.2.21-3, the applicant proposed to delete the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program and implement periodic inspections as an exception to its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program (and its subsequent deletion of this program) and its evaluation is documented in SER Section 3.0.3.1.23.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were evaluated by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.1 provides the FSAR supplement for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2. The staff also notes that the applicant committed (Commitment No. 16) by letter dated November 12, 2010, to the following:

> Program administrative controls will be revised to incorporate periodic volumetric examinations of ASME Code Class 1 small-bore socket welds. A volumetric examination technique will be developed capable of detecting cracking in Class 1 socket welds. The total number of socket welds selected for examination will be at least 10% of the total population per interval. Prior to the period of extended operation, CR-3 will perform a baseline inspection equivalent to ⅓ of those inspections required for an interval. The regular inspection schedule is to commence in the 3rd period of the 4th ISI interval.

The staff determines that the information in the FSAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, the staff finds all program elements consistent with the GALL Report. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Water Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.2 describes the existing Water Chemistry Program as consistent with GALL AMP XI.M2, "Water Chemistry." The applicant stated that the program has been established to mitigate the effects of degradation on the surfaces of materials exposed to water as a process fluid by controlling water chemistry for impurities (e.g., dissolved oxygen, chlorides, fluorides, sulfates) that accelerate corrosion and cracking. The applicant further stated that the program relies upon the monitoring and control of water chemistry to keep the peak levels of contaminants below system specific limits. In addition, the applicant also stated that in some instances, chemical agents (e.g., corrosion inhibitors, oxygen scavengers, biocides) are introduced into specific systems to prevent certain aging mechanisms. The applicant further stated that the program is based upon the latest version of the Electric Power Research Institute (EPRI) guidelines and will be updated as revisions to those guidelines are released.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M2. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M2, with the exception of the "monitoring and trending" program element. For this element the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted that the "monitoring and trending" program element of GALL AMP XI.M2 includes periodic monitoring and control of known detrimental contaminants in accordance with the EPRI water chemistry guidelines for pressurized water reactors (PWR). The staff noted that EPRI report 1014986, "Pressurized Water Reactor Primary Water Chemistry Guidelines" (2007), provides guidance to monitor silica in the RCS during daily startup. During its audit, the staff noted that the applicant's procedures do not provide guidelines for measuring silica in the RCS during reactor startup, which is included in the EPRI guidelines and the CR-3 optimized primary chemistry program. By letter dated September 11, 2009, the staff issued RAI B.2.2-1 requesting that the applicant provide additional information on the total silica monitoring program schedule during reactor system startup in order to address the discrepancy between the sampling procedure and monitoring scheduling procedure.

In its response dated October 13, 2009, the applicant stated that its sampling procedure is consistent with the EPRI guidelines and the discrepancy between the sampling procedure and the monitoring scheduling procedure is being corrected.

Based on its review, the staff finds the applicant's response to RAI B.2.2-1 acceptable because the applicant stated it will alter its monitoring scheduling procedure to be consistent with EPRI guidelines and GALL AMP XI.M2 for the sampling of total silica during startups. The staff's concern described in RAI B.2.2-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.2-1, the staff finds that program elements one through six of the applicant's Water Chemistry Program are consistent with the corresponding program elements of GALL AMP XI.M2 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.2 summarizes operating experience related to the Water Chemistry Program. The applicant provided an industry operating experience example related to inadvertent introduction of contaminants into the primary coolant system and stated that the applicable recommendations have been captured. The applicant also provided a site-specific example of operating experience when, during a startup from a refueling outage, the pressurizer water space experienced a high dissolved oxygen concentration. The applicant stated that the cause of the higher oxygen levels was insufficient venting of the pressurizer during startup and that corrective actions included a revision to an operating procedure to include reinforcing information on the importance of venting the pressurizer during startup.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specfic operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating

experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.2 provides the FSAR supplement for the Water Chemistry Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, and 3.5-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Water Chemistry Program and the applicant's response to the RAI, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Boric Acid Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.4 describes the existing Boric Acid Corrosion Program as consistent with GALL AMP XI.M10, "Boric Acid Corrosion." The applicant stated that this program implements systematic measures to ensure that leaking borated coolant does not lead to the degradation of the leakage source or adjacent mechanical, electrical, and structural components susceptible to boric acid corrosion. The applicant also stated that the program consists of visual inspection of external surfaces, timely discovery of leak paths, removal of boric acid residues, assessment of damage, and follow-up inspections. The applicant further stated that the program was developed in response to the recommendations contained in NRC Generic Letter (GL) 88-05.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding element of GALL AMP XI.M10. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M10 with the exception of the "acceptance criteria" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

In its review of the "acceptance criteria" program element, the staff noted that the applicant's procedures discuss deviations to the acceptance criteria but do not define how the deviations will be processed. By letter dated September 11, 2009, the staff issued RAI B.2.4-1 requesting that the applicant provide information regarding how deviations from the acceptance criteria were addressed. In its response dated October 13, 2009, the applicant provided its deviation procedures which specify that deviations are infrequent occurrences which are procedurally governed and involve the Boric Acid Corrosion Control Program Manager and potentially involve a nuclear condition report (NCR). The staff finds this program acceptable because the applicant's deviation process is sufficiently documented and rigorous to ensure appropriate decisions are made concerning adherence to the Boric Acid Corrosion Program acceptance criteria.

Operating Experience. LRA Section B.2.4 summarizes operating experience related to the Boric Acid Corrosion Program. The applicant stated that the program is implemented to meet regulatory, process, and procedure requirements which include periodic assessments and review of operating experience. The applicant also described two examples of operating experience associated with boric acid in the LRA. In the first of these examples, boric acid residue was being removed from valve packing. During the procedure, semi-wet boric acid leakage was observed. This leakage dripped on process piping and the floor. The source of the leak was repaired. No degradation was detected on affected piping because it was composed of stainless steel. In the second example, a Swagelok fitting was found to be leaking at the rate of two drops per minute. Following the procedures to address boric acid leakage, the fitting was tightened and the leak was stopped.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.4 provides the FSAR supplement for the Boric Acid Corrosion Program. The staff reviewed the FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, 3.5-2, and 3.6-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Boric Acid Corrosion Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program

Summary of Technical Information in the Application. LRA Section B.2.5 describes the existing Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program as consistent with GALL AMP XI.M11A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors." The applicant stated that the program meets the requirements of First Revised NRC Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," as amended. The program provides for the periodic inspection of the reactor pressure vessel head and vessel head penetration nozzles. The applicant stated that the reactor pressure vessel head was replaced in fall 2003. The applicant further stated that Alloy 690 was used for the control rod drive mechanism (CRDM) nozzles to minimize the concerns associated with primary water stress-corrosion cracking (PWSCC) of Alloy 600 nozzle material.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M11A. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M11A, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted that GALL AMP XI.M11A states that the augmented inspection requirements established in First Revised Order EA-03-009 include visual testing (VT)-2 and nondestructive examinations (NDEs). The final rule for 10 CFR 50.55a, "Codes and Standards," dated September 10, 2008, which supersedes the Revised Order, requires all licensees to augment their ISI program with ASME Code Case N-729-1, by December 31, 2008. The staff noted that the examination requirements for reactor vessel upper heads are visual examination, and volumetric and/or surface examination. The staff further noted that the personnel performing the visual examination shall be qualified as VT-2 visual examiners and shall have completed at least 4 hours of additional training in detection of borated water leakage. The staff noted that the transition from the Revised Order requirements to the requirements of 10 CFR 50.55a have been incorporated in the applicant's ISI Components and Structures Examination Program, Revision 8, Section 2.2, "Augmented Examination Requirements," of the ISI program basis document, which states that Code Case N-729-1 will be implemented during refueling outage (RFO) 18 in 2013, in accordance with 10 CFR 50.55a. The applicant also stated that the reactor vessel upper head shall receive a visual inspection every other outage starting with the first outage after January 1, 2009, and a volumetric inspection not to exceed every 10 calendar years following the initial examination. The staff noted the need for additional information regarding the specific schedules for the visual and volumetric inspections and how the additional training for visual examination will be implemented.

In RAI B.2.5-1 dated September 11, 2009, the staff requested that the applicant provide specific schedules for the visual and volumetric inspections and how the additional training for visual examination will be implemented.

In its response dated October 13, 2009, the applicant stated that visual inspections are scheduled for October 8, 2009, and volumetric examinations for RFO 18 are scheduled for 2013, in accordance with Code Case N-729-1. The applicant also stated that the ISI Components and Structures Examination Program has been revised to incorporate the requirements of Code Case N-729-1 subject to the conditions specified in paragraphs (g)(6)(ii)(D)(2) through (g)(6)(ii)(D)(6) of 10 CFR 50.55a.

Based on its review, the staff finds the applicant's response to RAI B.2.5-1 acceptable because the applicant has provided the schedule information for the visual and volumetric inspections. The applicant also incorporated the requirements of 10 CFR 50.55a in its ISI program, as required by the final rule for 10 CFR 50.55a, dated September 10, 2008, that supersedes the Revised Order requiring all licensees to augment their ISI program with the ASME Code Case N-729-1, by December 31, 2008. The staff's concern described in RAI B.2.5-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.5-1, the staff finds that elements one through six of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program are consistent with the corresponding program elements of GALL AMP XI.M11A and, therefore, are acceptable.

Operating Experience. LRA Section B.2.5 summarizes operating experience related to the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program. The applicant stated that operating experience for the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program is effective in detecting cracks in the upper vessel head penetration nozzles and any loss of material/wastage of the upper reactor vessel prior to a loss of intended function of the components. During the audit, the staff reviewed the applicant's operating experience reports. The staff noted that during the refueling outage in 2007, after reactor pressure vessel head replacement, a 100 percent bare metal visual examination detected no evidence of boron leakage and corrosion of the head. The applicant observed a white flakey substance on the surface of the head, but it was determined not to be boron.

The staff determined that the documentation provided by the applicant during the onsite review supports the applicant's statements regarding operating experience and confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.5 provides the FSAR supplement for the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The applicant stated that the required inspections are performed, per the plant ISI program, as augmented inspections. In its ISI Components and Structures Examination Program, Revision 8, the applicant committed to the new augmented inspection requirements for the reactor vessel upper head and vessel head penetration nozzles that are mandated in 10 CFR 50.55a.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Summary of Technical Information in the Application. LRA Section B.2.6 describes the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)." The applicant's Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program augments the ISI program for reactor vessel internals (RVIs), in accordance with ASME Code Section XI, Subsection IWB and Category B-N-3. This augmented inspection program manages the effects of thermal aging and neutron irradiation embrittlement for CASS materials. The applicant further stated that the augmented inspection includes RVI CASS components determined to be potentially susceptible to thermal aging and/or subjected to neutron fluence of greater than 1×10^{17} neutrons per square centimeter (n/cm^2) (E > 1 MeV). The applicant also stated that this AMP allows for a component-specific evaluation; however, if a mechanical loading and component assessment determines that the loading is compressive or low enough to preclude fracture, then the augmented inspection is not required for that component.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M13. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M13, with the exception of the "scope of the program" and "detection of aging effects" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

GALL AMP XI.M13 recommends that for potentially susceptible components, the synergistic loss of fracture toughness due to both neutron embrittlement and thermal aging be considered. However, during its audit, the staff could not determine if the synergistic effects of thermal and irradiation embrittlement for all susceptible materials were included.

In RAI B.2.6-1 dated September 11, 2009, the staff requested that the applicant provide additional information that justifies limiting the synergistic loss of fracture toughness consideration to fluence levels greater than 1×10^{21} n/cm^2 (E > 1 MeV) in lieu of the GALL Report recommended levels greater than 1×10^{17} n/cm^2 (E > 1 MeV) limit. In addition, the applicant was asked to describe whether this proposed limit is consistent with other industry guidelines (e.g., EPRI MRP-227, "PWR Reactor Internals Inspection & Evaluation Guidelines").

In its response dated October 13, 2009, the applicant stated that its program basis document has been updated to include information from MRP-175, as referenced by MRP-189, "Screening, Categorization, and Ranking of B&W-Designed PWR Internals Component Items," Revision 1, March 2009. The staff noted that this document identifies a threshold of greater than 6.7×10^{20} n/cm^2 (E > 1 MeV) for CASS to express susceptibility to irradiation embrittlement, and to account for synergistic loss of fracture toughness, the threshold for CASS materials is lowered by half to greater than or equal to 3.3×10^{20} n/cm^2 (E > 1 MeV). The staff further noted that these reports were incorporated by reference into MRP-227. The applicant further stated that the aging management strategies for the subject components are derived from MRP-227, and the LRA was revised to state that the augmented inspections for the CASS RVI components are in conformance with MRP-227. The applicant committed (Commitment No. 4) that when the staff provides an SER on the MRP-227, any required actions that affect the aging management strategy for these components will be incorporated in this program's document.

Based on its review, the staff finds the applicant's response to RAI B.2.6-1 acceptable because the applicant has indicated that the basis document and the LRA have been revised to clarify the basis for consideration of synergistic loss of fracture toughness greater than the GALL Report recommended levels greater than 1×10^{17} n/cm^2 (E > 1 MeV). The applicant has also committed (Commitment No. 4) to incorporate any recommended actions that originate from the staff's SER for MRP-227. The staff's concern described in RAI B.2.6-1 is resolved.

GALL AMP XI.M13 recommends that an augmented ISI program would ensure detection of a critical flaw size with adequate margin. However, during its audit, the staff could not determine what technique the applicant was using to ensure detection of a critical flaw size with adequate margin.

In RAI B.2.6-2 dated September 11, 2009, the staff requested that the applicant provide additional information on the augmented inspection program of the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program that indicates how it is consistent with the GALL Report recommendations.

In its response dated October 13, 2009, the applicant stated that, "the basis document has been updated to include the latest information available from MRP-227, 'Pressurized Water Reactor Internals Inspection and Evaluation Guidelines.'" The applicant also identified that the supplemental inspections are based on its participation in industry programs for investigating and managing aging effects on reactor internals. The applicant further stated that it will implement the results from industry programs. The applicant also committed (Commitment No. 4), to incorporate into its program basis documents, any required actions that originate from the staff's SER for MRP-227 affecting aging management strategy.

Based on its review, the staff finds the applicant's response to RAI B.2.6-2 acceptable because the applicant stated that its program basis documents have been updated to include information available from MRP-227, applicable to the augmented inspection of the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The applicant has also committed (Commitment No. 4) to incorporate any required actions that originate from the staff's SER for MRP-227. The staff's concern described in RAI B.2.6-2 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.2.6-1 and B.2.6-2, the staff finds that elements one through six of the applicant's Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program are consistent with the corresponding program elements of GALL AMP XI.M13 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.6 summarizes operating experience related to the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The applicant indicated that this was a new program which is based on operating experience. The applicant further stated that when it implemented this program, it considered industry operating experience. The applicant further stated that because this is a new program that has not been implemented, there is currently no plant-specific operating experience to validate the effectiveness of this program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.6 provides the FSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff also noted that the applicant committed (Commitment No. 4) to implement the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program prior to entering the period of extended operation for managing aging of applicable components and when an SER is issued for MRP-227, any required actions that affect the aging management strategy for these components will be incorporated into the program documents.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.2.7 describes the existing Flow-Accelerated Corrosion Program as consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion." The applicant stated the following regarding the program:

> The Flow-Accelerated Corrosion (FAC) Program provides for prediction, detection, and monitoring of FAC in plant piping and other piping components so that timely and appropriate action may be taken to minimize the probability of experiencing a FAC-induced consequential leak or rupture. The FAC Program is based on the guidance provided in NSAC-202L, "Recommendations for an Effective FAC Program," and includes conducting an analysis to determine critical locations, performing limited baseline inspections to determine the extent of thinning at these locations, performing follow-up inspections to confirm the predictions, and repairing or replacing the components as necessary.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff confirmed that the Flow-Accelerated Corrosion Program contains all the elements of the referenced GALL Report program and that the plant conditions are bounded by the conditions for which the GALL Report was evaluated.

In comparing program elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M17, the staff noted that each element of the applicant's program is consistent with the corresponding element of the GALL AMP XI.M17, with the exception of the "scope of program" and "parameters monitored or inspected" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

In LRA Section B.2.7, the applicant stated that the Flow-Accelerated Corrosion Program described in EGR-NGGC-0202, "Flow Accelerated Corrosion Monitoring Program," Revision 10, is based on EPRI guidance document NSAC-202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program," Revision 3, dated May 2006. The GALL Report recommends the use of Revision 2 of NSAC-202L. In RAI B.2.7-1 dated September 11, 2009, the staff requested that the applicant provide a discussion of the differences between Revisions 2 and 3 of the EPRI guidance document NSAC-202L and provide a discussion as to why this is not considered an exception to the GALL Report. In its response dated October 13, 2009, the applicant stated:

> In summary, EPRI Report NSAC-202L-R3 [Revision 3] provides enhanced guidance with lessons learned since Revision 2 of this document was published in April 1999, updates the worldwide FAC operating experience, and provides recent developments in detection, modeling, and mitigation technology without contradiction of the previous revision. Both Revision 3 and Revision 2 of NSAC-202L present a set of recommendations for nuclear power plants to implement an effective program in detecting and mitigating FAC. Based on the above information, the use of EPRI NSAC-202L, Revision 3, meets the intent of NUREG-1801, Section XI.M17, and so is not considered an exception to the GALL Report.

The staff finds the applicant's response acceptable because NSAC-202L, Revision 3 meets the intent of Revision 2, which makes the applicant's program consistent with GALL AMP XI.M17. The staff's concern described in RAI B.2.7-1 is resolved.

In LRA Section B.2.7, the applicant stated that the Flow-Accelerated Corrosion Program monitors the effect of flow-accelerated corrosion on the intended function of piping and components by measuring wall thickness. It was further stated that selection and prioritization of components to be inspected consider NSAC-202L, using multiple criteria including CHECWORKS model predictions, trending, consequences of failure, engineering judgment, and plant and industry operating experience events. The LRA did not contain information regarding the accuracy of the Flow-Accelerated Corrosion Program in predicting flow-accelerated corrosion degradation in components. In RAI B.2.7-2 dated September 11, 2009, the staff requested that the applicant provide a sample list of components for which thinning is predicted and measured by UT or other methods in order to assess the accuracy of the flow-accelerated corrosion predictions from CHECWORKS.

In its response dated October 13, 2009, the applicant included a sample list of condensate system components for which wall thinning is predicted and measured by UT in a table entitled "Wear Rate Analysis: Combined Summary Report." The list includes the initial wall thickness (nominal), current (measured) wall thickness, and the thickness predicted by the CHECWORKS flow-accelerated corrosion model. The staff reviewed the table and determined that more information was needed to complete its review. In RAI B.2.7-2.1 dated November 30, 2009, the staff requested that the applicant clarify and describe the information in the "Wear Rate Analysis: Combined Summary Report" table.

In its response dated January 27, 2010, the applicant clarified the information in the "Wear Rate Analysis: Combined Summary Report" table and stated the following:

> The initial wall thickness for any given wear rate run is based on the nominal wall thickness required by the original design specification for the piping. The measured initial wall thickness always meets or exceeds the nominal wall thickness required by the design specification. For uninspected components, CHECWORKS uses the initial wall thickness as the measured wall thickness upon which to base wall thickness predictions. For inspected components, CHECWORKS uses the minimum measured wall thickness. For uninspected

components, predicted wall thickness is based on the initial wall thickness since CHECWORKS has no measured value to base future predictions. For inspected components, predicted wall thickness is based on the measured wall thickness from the minimum measured UT wall thickness.

The data submitted by the applicant shows that the CHECWORKS flow-accelerated corrosion model predicts the measured thickness within 4 percent of the actual average measured thickness. The CHECWORKS flow-accelerated corrosion model predicted measurements are conservative when compared to the actual measurements of the components and the highest average wear rate was observed to be 3.9 millimeters per year for piping component 108-001N in the condensate system. In addition, the applicant stated that repair or replacement of components will be made as necessary. The staff has reviewed the sample list of components susceptible to flow-accelerated corrosion and performed independent calculations and has determined that the Flow-Accelerated Corrosion Program is adequate in predicting the rate of material loss because it is able to conservatively predict the rate of degradation for piping. As such, the staff has determined that the applicant's program is consistent with GALL AMP XI.M17. The staff's concern described in RAI B.2.7-2 is resolved.

Based on its review, the staff finds that program elements one through six of the applicant's Flow-Accelerated Corrosion Program are consistent with the corresponding program elements of GALL AMP XI.M17 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.7 summarizes operating experience related to the Flow-Accelerated Corrosion Program. The staff reviewed this information and interviewed the applicant's technical personnel during the onsite audit to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently verified that the applicant had adequately incorporated and evaluated operating experience related to this program. Specific CR-3 examples of operating experience include:

- Several components in the secondary plant systems have low margin to the limiting acceptance criteria and continue to experience FAC degradation. These components will require more frequent inspection, and will eventually require replacement.

- CR-3 FAC personnel attended the January 2008 CHECWORKS User Group meeting in which a presentation was made on the FAC entrance effect. EPRI Report TR1015072, "Flow-Accelerated Corrosion – The Entrance Effect," issued in November 2007, as well as the report recommendations, were discussed.

- In addition, utility representatives shared OE [operating experience] and new techniques for measuring wall thickness. This benchmarking of OE demonstrates that CR-3 is staying abreast of FAC best practices.

The staff reviewed the applicant's operating experience and has determined that the performance of frequent inspections and replacement of components demonstrate adequate measures taken to mitigate or prevent loss of material due to flow-accelerated corrosion. In addition, the staff finds the applicant's participation in industry working groups enhances its ability to obtain and evaluate operating experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

FSAR Supplement. LRA Section A.1.1.7 provides the FSAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed the FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, and 3.4-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Flow-Accelerated Corrosion Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Steam Generator Tube Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.9 describes the existing Steam Generator Tube Integrity Program as consistent with GALL AMP XI.M19, "Steam Generator Tube Integrity." The applicant stated that the program is performed as part of the overall Steam Generator Integrity Program. The applicant credited the program for aging management of the tubes, tube plugs, sleeves, tube supports, and the secondary-side components whose failure could prevent the steam generator from fulfilling its intended safety function. The applicant stated the Steam Generator Integrity Program is based on technical specification (TS) requirements and meets the intent of NEI 97-06, "Steam Generator Program Guidelines." It further stated that the program manages aging effects by providing a balance of prevention, inspection, evaluation, repair, and leakage monitoring. The applicant explained that preventive measures to mitigate degradation related to corrosion phenomena are implemented via primary-side and secondary-side water chemistry monitoring and control. The applicant also stated that the Steam Generator Tube Integrity Program includes requirements for foreign material exclusion in order to inhibit wear degradation and provides actions to be taken in response to finding foreign objects.

The applicant further stated that the Steam Generator Tube Integrity Program provides the requirements for inspection activities for the detection of flaws in tubing, plugs, sleeves, tube supports, and secondary-side internal components needed to maintain tube integrity. The applicant described that degradation assessments identify both potential and existing degradation mechanisms; inservice inspections (i.e., eddy current testing and visual inspections) are used for the detection of flaws; condition monitoring compares the inspection results against performance criteria; and an operational assessment provides a prediction of tube conditions to ensure that the performance criteria will not be exceeded until the next refueling outage or the next steam generator inspection. The applicant further stated that primary-to-secondary leakage is continually monitored during operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M19. As discussed in the Audit Report, the staff determined that elements one through six of the applicant's program required additional information which resulted in the issuance of RAIs.

The staff noted that the applicant stated in LRA Section B.2.2 that the Water Chemistry Program is currently based on the latest version of the EPRI guidelines and this program will be updated as revisions to the guidelines are released. The staff finds that the use of these more recent guidelines is consistent with GALL AMP XI.M2, which states that the Water Chemistry Program for PWRs relies on monitoring and control of reactor water chemistry based on industry guidelines for primary water and secondary water chemistry such as EPRI TR-105714, Revision 3 and TR-102134, Revision 3 or later revisions. Since the "preventive actions" program element of GALL XI.M19 refers to GALL AMP XI.M2 for monitoring and maintaining reactor water chemistry, the staff finds that this aspect concerning water chemistry of the "preventive actions" program element of GALL AMP XI.M19 is acceptable.

During its review of the applicant's program basis document, the staff noted that the "scope of program" program element references Revision 2 of NEI 97-06, "Steam Generator Program Guidelines," for its Steam Generator Tube Integrity Program. The staff noted that the "scope of program" program element of GALL AMP XI.M19 states that the applicant's program is, in part, implemented in accordance with Revision 1 of NEI 97-06. As a result of the differences in the revisions of NEI 97-06, by letter dated September 11, 2009, the staff issued RAI B.2.9-1 requesting that the applicant justify its use of Revision 2 of NEI 97-06.

In its response dated October 13, 2009, the applicant explained that the staff issued Revision 1 of the GALL Report in September 2005, whereas Revision 2 of NEI 97-06 was issued in May 2005, and thus was not included in GALL AMP XI.M19.

The applicant stated that by letter dated October 3, 2005, the staff sent a letter to NEI concerning Revision 2 of NEI 97-06 (ADAMS Accession No. ML052780111). In its letter, the staff stated that Revision 2 of NEI 97-06 is consistent with Technical Specification Task Force Traveler (TSTF) 449, Revision 4, "Steam Generator Tube Integrity," which was approved in May 2005 and published in the *Federal Register* on May 6, 2005. The applicant stated by letter dated May 16, 2007, the staff issued Amendment No. 223 to Facility Operating License for CR-3 (ADAMS Accession No. ML071340112) that consisted of changes to the existing TSs, which revised the steam generator tube surveillance program to one modeled after TSTF-449.

Based on its review, the staff finds the applicant's response to RAI B.2.9-1 acceptable because Revision 2 of NEI 97-06 is consistent with the applicant's TSs and with TSTF 449, Revision 4 which was previously approved by the staff. Thus, the staff's concern described in RAI B.2.9-1 is resolved.

The staff noted in the "parameters monitored/inspected" and "detection of aging effects" program elements of the applicant's program is supported by a once through steam generator (OTSG) ISI manual relative to visual inspection of tube plugs. The staff further noted in this document, the applicant used the phrase "PGN approved procedures" without referencing these procedures in this document. By letter dated September 11, 2009, the staff issued RAI B.2.9-5 requesting that the applicant identify the specific "PGN approved procedures" discussed in this manual.

In its response dated October 13, 2009, the applicant stated that the procedures referenced are vendor's procedures that must be approved by the applicant prior to their use.

Based on its review, the staff finds the applicant's response to RAI B.2.9-5 acceptable because the applicant clarified that procedures being referenced in its OTSG ISI manual are procedures provided by the vendors for the visual inspection of tube plugs and that prior to using these procedures they must be approved by the applicant. The staff's concern described in RAI B.2.9-5 is resolved.

The staff noted the "parameters monitored/inspected" and "acceptance criteria" program elements are supported by a standard procedure that summarizes all the aspects of the Steam Generator Tube Integrity Program, such as ISIs, assessment of degradation mechanisms, and plugging or repair. During its review, the staff noted that some definitions, criteria, or expressions used by the applicant were too restricting or insufficiently documented to verify their consistency with the requirements of the ASME Code or with the recommendations of the GALL Report. The staff's concerns were described in RAIs B.2.9-3 and B.2.9-4.

By letter dated September 11, 2009, the staff issued RAI B.2.9-3 requesting that the applicant discuss how the term "faulted" is used in the program and, if it is used, the reason for only limiting the definition to secondary-side depressurizations.

In its response dated October 13, 2009, the applicant stated that this definition is not part of NEI 97-06, Revision 2 and that a procedure revision request has been generated to remove it from the corporate procedure. It further stated that, as stated in the response to RAI B.2.9-2, the program review process would ensure that the procedures are internally consistent and compliant with the TSs and are consistent with NEI 97-06.

Based on its review, the staff finds the applicant's response to RAI B.2.9-3 partly acceptable because the applicant stated that its definition of "faulted" was not part of NEI 97-06, Revision 2 guidelines and that it would remove it from the corporate procedure. However, the staff also found the applicant's response partly inadequate because the applicant referenced its program review process, which the staff noted in RAI B.2.9-2 as not completely effective to ensure the procedures are internally consistent, compliant with the TSs, and consistent with NEI 97-06. The staff's concern is discussed in more detail in RAI B.2.9-2, as described below.

The staff noted during the audit that the applicant's procedures seem unclear on the requirements pertaining to steam generator tube plugging, sleeving, and NDE. Therefore, by letter dated September 11, 2009, the staff issued RAI B.2.9-4 requesting that the applicant confirm that the ASME Code requirements pertaining to steam generator tube plugging, sleeving, and NDE are being followed (for those instances where there is no conflict with the specific requirements in the TSs).

In its response dated October 13, 2009, the applicant confirmed that the ASME Code requirements pertaining to steam generator tube plugging, sleeving, and NDE are being followed (for those instances where there is no conflict with the specific requirements in the TSs).

Based on its review, the staff finds the applicant's response to RAI B.2.9-4 acceptable because it meets the requirements of 10 CFR 50.55a(b)(2)(iii). The staff's concern described in RAI B.2.9-4 is resolved.

With respect to the overall review of the "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the Steam Generator Tube Integrity Program, the applicant stated that its program meets the intent of NEI 97-06 as recommended by the GALL Report. The staff noted that this program is supported by numerous implementing documents. During its review, the staff identified numerous potential discrepancies within the same procedure, between different procedures, between the procedures and various industry guidelines (referenced in NEI 97-06), and between the procedures and the TSs. Given the number of potential discrepancies, the staff, by letter dated September 11, 2009, issued RAI B.2.9-2 requesting that the applicant discuss its plans to perform a comprehensive review of its steam generator program to ensure the procedures are internally consistent, will ensure compliance with the TSs, and are consistent with NEI 97-06.

In its response dated October 13, 2009, the applicant stated that the Steam Generator Tube Integrity Program is defined as an "Engineering Program" per corporate procedure and is reviewed on a frequency not to exceed 2 years. The applicant explained that the most recent review (March 2008) concluded that the program met the requirements of the TSs. It also stated that this review process would ensure that the procedures are internally consistent and compliant with the TSs and are consistent with NEI 97-06.

Based on its review, the staff finds the applicant's response to RAI B.2.9-2 unacceptable because the applicant stated that its Steam Generator Tube Integrity Program met the requirements of the TSs, whereas the staff noted many points invalidating this statement. Moreover, the staff cannot verify that the modifications to be made to the program will be consistent with the GALL Report.

By letter dated February 2, 2010, the staff issued follow-up RAI B.2.9-2.1 requesting that the applicant describe why its "Engineering Program" assessment of March 2008 did not identify the inconsistencies that the staff identified during its audit of the Steam Generator Tube Integrity Program. The staff also requested that the applicant clarify how its "Engineering Program" review process, as applied to the Steam Generator Tube Integrity Program, will be effective during future implementation in providing assurance that the revised procedures will be internally consistent, compliant with the TSs, and consistent with NEI 97-06 during the period of extended operation.

In its response dated March 3, 2010, the applicant clarified that the "Engineering Program" assessment referenced in response to RAI B.2.9-2 was focused on the Operational Assessment justifying operation to the end of the current operating cycle and on the pre-service eddy current plans for the replacement steam generators and outage readiness and that this assessment did not include a detailed review of all the associated procedures. The applicant also stated that the potential discrepancies identified during the staff's audit have been documented in its corrective action program. Furthermore, the applicant stated that, based on the findings of the staff's audit, it will add a commitment to enhance the procedures to comply with the requirements with GALL AMP XI.M19, "Steam Generator Tube Integrity," and that these enhancements will be completed prior to the period of extended operation.

Based on its review, the staff finds the applicant's responses to RAIs B.2.9-2, B.2.9-3, B.2.9-4, and B.2.9-2.1 acceptable because the applicant explained why its "Engineering Program" assessment in 2008 was ineffective in discovering the discrepancies identified by the staff during its audit and documented these discrepancies in its corrective action program. Moreover, the staff noted that the applicant will enhance its implementing procedures related to its Steam Generator Tube Integrity Program in order to comply with the recommendations of GALL AMP XI.M19 prior the period of extended operation.

Accordingly, in its response to RAI B.2.9-2.1 dated March 3, 2010, the applicant amended its LRA to include the following paragraph to LRA Subsection A.1.1.9 and Commitment No. 30:

> Prior to the period of extended operation, the Steam Generator Tube Integrity Program implementing procedures will be enhanced to ensure compliance with the requirements in NUREG-1801, Revision 1, Section XI.M19.

Therefore, the applicant also revised LRA Table B-1 and Section B.2.9 to state that its Steam Generator Tube Integrity Program is an "Existing program consistent with NUREG-1801 with enhancement."

The applicant also amended its LRA to include an enhancement to LRA Section B.2.9 to enhance the implementing proceures to ensure consistency with the recommendations described in GALL AMP XI.M19.

The staff finds this change to LRA Table B-1 and Section B.2.9 acceptable because it clarifies that the applicant is committed (Commitment No. 30) to enhance its implementing procedures related to the Steam Generator Tube Integrity Program in order to ensure consistency with the recommendations of GALL AMP XI.M19. The staff's review of this enhancement and its acceptability is documented below.

Based on its review, the staff finds that the applicant has: adequately addressed the issues in RAIs B.2.9-2, B.2.9-3, B.2.9-4, and B.2.9-2.1; amended its LRA appropriately; and identified an enhancement to the "scope of program" program element of its Steam Generator Tube Integrity Program. The staff's concerns described in RAIs B.2.9-2 and B.2.9-4 are resolved.

The staff also reviewed the portions of the "scope of program" program element associated with the enhancement, as amended by letter dated March 3, 2010, to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement. LRA Section B.2.9 states an enhancement to the "scope of program" program element, as amended by letter dated March 3, 2010. The applicant stated that the implementing procedures for the program will be enhanced to ensure compliance with the recommendations described in GALL AMP XI.M19, prior to the period of extended operation.

The staff reviewed the applicant's enhancement and noted that, prior to the period of extended operation, the applicant will revise its implementing procedures to be consistent with the recommendations from GALL AMP XI.M19.

Based on its review, the staff finds this enhancement is acceptable because the applicant's implementing procedures will be revised such that they are consistent with the recommendations from GALL AMP XI.M19.

Based on its audit and review of the applicant's responses to RAIs B.2.9-1, B.2.9-2, B.2.9-2.1 B.2.9-3, B.2.9-4, and B.2.9-5, the staff finds that elements one through six of the applicant's Steam Generator Tube Integrity Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.M19 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.9 summarizes operating experience related to the Steam Generator Tube Integrity Program. The applicant stated that it uses operating experience to promote the identification and transfer of lessons learned from both internal and industry events so that the knowledge gained can be used to improve nuclear plant safety and operations. Furthermore, operating experience provides the methodology for receiving, processing, status reporting, screening, reviewing, evaluating, and taking preventive and corrective actions in response to this information. In order to support its conclusion that no tube integrity-related degradation has resulted in loss of component intended function, the applicant stated that its program is continually upgraded based on industry experience, external and internal assessments, and routine program performance and has provided an effective means of ensuring steam generator tube integrity. The applicant explained that overall effectiveness of the Steam Generator Integrity Program is supported by the operating experience for SSCs.

The applicant stated that it reviewed different sources of operating experience, such as NRC generic communications, licensee event reports, and Institute of Nuclear Power Operations (INPO) operating experience reports for applicability to its Steam Generator Tube Integrity Program. The applicant stated that it uses this information in order to verify whether operating experience directly or indirectly related to its steam generators and the concerns identified have been addressed in the Steam Generator Tube Integrity Program. Additionally, the applicant further explained that it has submitted an application for improved TSs consistent with NRC and industry adoption of improved steam generator TSs.

In LRA Section B.2.9, the applicant also provided examples of plant-specific operating experience. The staff noted that one example relates to the crack indications in steam generator Alloy 600 rolled plugs (INPO operating experience) that the applicant previously experienced but were confined to certain susceptible material heats. The applicant initiated corrective actions that included the repair of four plugs by removing the old plug and installing either a new Alloy 690 rolled or welded plug. Since then, the applicant has not used the identified susceptible plug material heats and has not found any crack indications in the plugs. However, for future outages the applicant will continue to use eddy current inspection on all remaining Alloy 600 rolled plugs by using a rotating coil probe to inspect 100 percent of the Alloy 600 rolled plugs in the hot and cold legs of its steam generators. The staff noted that the applicant's program was able to identify the crack indications and then take corrective actions to prevent recurrence.

The staff noted the second example relates to an unidentified object discovered during eddy current testing conducted during the fall 2007 outage in one of the OTSG-B tubes that prevented the complete inspection of the tube. The applicant attempted to dislodge the object but failed, the applicant then decided to plug the tube instead of expending significant dose to identify and retrieve the object. The applicant verified with eddy current testing that the unobstructed sections of the tube did not have any significant degradation. The applicant determined that since the object was captured within the tube, the tube could be removed from service by plugging, and that no additional actions (such as stabilization) were necessary. The staff noted the tube was plugged by installing AREVA rolled plugs made from Alloy 690 material. The applicant performed additional investigations to determine that the object was a piece of a fuel assembly grid strap. The applicant identified the causal factors and set up corrective actions for refueling planning and fuel handling techniques in order to prevent future occurrences of loose fuel assembly grid strap fragments and limit the potential interactions as the core is loaded. The staff noted that the applicant's program was able to identify the piece of lodged fuel assembly grid strap inside the tube and then take corrective actions to remove the tube from service and prevent future occurrences of loose fuel assembly grid strap fragments.

The applicant further stated that the active degradation mechanisms in the steam generators include upper bundle axial outside diameter stress corrosion cracking/intergranular attack (ODSCC/IGA), axial ODSCC/IGA in the upper tubesheet crevice, axial and circumferential PWSCC in roll expansion regions, general volumetric degradation, wear at tube support locations, volumetric degradation in the first span region of OTSG-B, and tube end cracks confined exclusively to the depth of the tubesheet clad.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.9, as amended by letter dated March 3, 2010, provides the FSAR supplement for the Steam Generator Tube Integrity Program.

The staff also notes that the applicant committed (Commitment No. 30) to enhance the Steam Generator Tube Integrity Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance implementing procedures for the Steam Generator Tube Integrity Program to ensure compliance with the recommendations in the GALL Report, Revision 1 prior to entering the period of extended operation for managing aging of applicable components.

The staff reviewed this amended FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff determines that the information in the FSAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Steam Generator Tube Integrity Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 30 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Aboveground Steel Tanks Program

Summary of Technical Information in the Application. LRA Section B.2.15 describes the new Aboveground Steel Tanks Program as consistent with GALL AMP XI.M29, "Aboveground Steel Tanks." The applicant stated that this program manages the aging effect of loss of material for external surfaces and inaccessible locations of fire service water storage tanks and one condensate storage tank. The applicant also stated that this program will rely on periodic system walkdowns and preventive maintenance visual inspections to monitor the condition of the coating, although the paint is not credited to perform a preventive function, on the external surfaces of the tanks and the sealing of the concrete foundation. The applicant further stated that thickness measurements will be performed from inside the tank to assess the tank bottom condition, and the frequency of the thickness measurements will be based on the findings of visual inspections performed.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M29. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M29, with the exception of the "detection of aging effects" and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification which resulted in the issuance of an RAI.

GALL AMP XI.M29 recommends use of thickness measurement of the tank bottom to ensure that significant degradation does not occur during the period of extended operation under the "detection of aging effects" program element and to detect the effects of corrosion of the underground external surface under the "monitoring and trending" program element description; however, the staff found that the applicant's Aboveground Steel Tanks Program lacked sufficient details of the ISI techniques and frequency of the inspections. By letter September 11, 2009, the staff issued RAI B.2.15-1 requesting that the applicant provide additional information to clarify how internal visual inspections are adequate to exclude corrosion of underground external surfaces if no additional thickness measurements are performed and justify the frequency of tank bottom thickness measurements.

In its response dated October 13, 2009, the applicant stated that it will perform UT thickness measurements of each tank's bottom to ensure that significant degradation does not occur within the 10-year period prior to the period of extended operation. The applicant also stated that inspection results that identify indications or relevant conditions of degradation will be compared to the tank design thickness and corrosion allowance. The applicant further stated that subsequent UT inspections would be based on the results of these inspections and industry experience as part of the corrective action program.

The staff finds the applicant's response to RAI B.2.15-1 acceptable because the applicant will perform UT tank bottom thickness inspections on all tanks prior to the period of extended operation, evaluate any relevant conditions against design thickness and corrosion allowance, and will base future inspections on these results and industry experience. The staff's concern described in RAI B.2.15-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.15-1, the staff finds that elements one through six of the applicant's Aboveground Steel Tanks Program are consistent with the corresponding program elements of GALL AMP XI.M29 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.15 summarizes operating experience related to the Aboveground Steel Tanks Program. The applicant stated that this is a new program and as such no operating experience exists to demonstrate effectiveness of the program. The applicant also stated that periodic inspections of the condensate storage tank found holes in the bottom of the tank. The applicant further stated that the holes were repaired and successfully visually inspected and nondestructively examined. During the audit, the staff noted that the results from the latest inspection in 2007 indicated the condition of the tank had not further degraded from the previous inspection. Also during the audit, the staff noted that a periodic inspection of the fire service water storage tanks performed in 2005 resulted in discovery of broken grout around the tank's perimeter, paint chalking on the external surfaces, and corrosion of the roof vents. Interviews with the applicant's staff revealed that there were no safety or structural concerns related to these findings and a correction action to inspect the exterior of the tanks annually to trend any further degradation was implemented.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.15 provides the FSAR supplement for the Aboveground Steel Tanks Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.3-2 and 3.4-2. The staff also notes that the applicant committed (Commitment No. 10) to implement the new program prior to entering the period of extended operation for managing the aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Aboveground Steel Tanks Program, the staff finds all the program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 One-Time Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.18 describes the new One-Time Inspection Program as being consistent with GALL AMP XI.M32, "One-Time Inspection." The applicant stated that this program will verify the effectiveness of an AMP and confirm the absence of an aging effect. The applicant further stated that the program includes verification inspections specified by the GALL Report for the Water Chemistry Program, Fuel Oil Chemistry Program, Lubricating Oil Analysis Program, and plant-specific inspections to confirm the condition of certain civil/structural components. The program will be implemented prior to the period of extended operation. LRA Section B.2.18 also provides a table that lists representative components in each applicable system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M32. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M32.

The staff noted during its review that additional information related to the "detection of aging effects" program element was required. Due to the uncertainty in determining the most susceptible locations and the potential for aging to occur in other locations, the staff noted that large sample sizes may be required in order to adequately confirm an aging effect is not occurring. The applicant's One-Time Inspection Program did not include specific information regarding how the population of components to be sampled or the sample size will be determined. Therefore, by letter dated November 30, 2010, the staff issued RAI B.2.18-1 requesting that the applicant provide specific information regarding how the population of components to be sample will be determined and the size of the sample of components that will be inspected. Pending receipt and review of the applicant's response, this issue has been identified as **OI–3.0.3.1.9–1**.

Based on its audit, the staff finds that elements one through six of the applicant's One-Time Inspection Program, pending resolution of OI–3.0.3.1.9–1, are consistent with the corresponding program elements of GALL AMP XI.M32 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.18 summarizes operating experience related to the One-Time Inspection Program. The applicant stated that this One-Time Inspection Program is a new program and that there is currently no operating experience related to this program. The staff noted that the applicant is committed to its process that one-time inspections will be prescribed and developed with consideration of plant and industry operating experience as it becomes available. The staff finds this approach acceptable.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.18 provides the FSAR supplement for the One-Time Inspection Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

The staff notes that the applicant committed (Commitment No. 13) by letter dated December 16, 2008, to implement the new One-Time Inspection Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's One-Time Inspection Program, the staff finds all program elements, pending resolution of OI–3.0.3.1.9–1, consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.2.20 describes the new Buried Piping and Tanks Inspection Program as being consistent with GALL AMP XI.M34 "Buried Piping and Tanks Inspection." The applicant stated that the program manages the aging effect of loss of material due to general, galvanic, pitting, crevice, and microbiologically-influenced corrosion for the external surfaces of buried steel components in systems within the scope of license renewal. The applicant also stated that the program manages this aging through preventive measures to mitigate degradation, such as coatings and wrappings, and visual inspections of external surfaces of the buried piping and tanks, when excavated, for evidence of coating damage and degradation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M34. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M34, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

SRP-LR Section A.1.2.3.4 recommends that the "detection of aging effects" program element should contain information concerning the frequency, extent, sample size, and methods used to detect aging; however, during its audit, the staff found that much of this information is absent from the applicant's Buried Piping and Tanks Inspection Program. By letter dated September 11, 2009, the staff issued RAI B.2.20-1 requesting that the applicant provide additional details of the proposed inspection program.

In its response dated October 13, 2009, the applicant stated that at least one inspection will be conducted in the 10 years prior to the period of extended operation and that at least one inspection will be conducted during each 10-year period which follows. The applicant also stated that additional inspections would be performed whenever pipe was exposed and that the program will use visual inspections. The applicant provided an extensive list of inspection criteria such as intact protective coating, and absence of holidays. The applicant further stated that in each inspection, a length of pipe sufficient to be representative of the section of pipe being inspected would be inspected. For directed inspections, the applicant stated that the location of the inspection would be based on operating experience and the highest probability of corrosion problems and that any degradation noted would be evaluated using the corrective action program to determine the need for additional inspections.

The staff finds the applicant's response acceptable because the applicant has addressed all aspects of an inspection program (i.e., method, frequency, sample size, sample location, and acceptance criteria) in a manner which is consistent with the GALL Report. The staff's concern described in RAI B.2.20-1 is resolved.

Subsequent to the evaluation of the applicant's response to this RAI, the staff noted an emerging trend of industry operating experience related to leakage from buried piping. The staff's evaluation of this trend is documented in RAI B.2.22-2 in the "operating experience" program element below.

Based on its audit and review of the applicant's response to RAI B.2.20-1, the staff finds that elements one through six of the applicant's Buried Piping and Tanks Inspection Program are consistent with the corresponding program elements of GALL AMP XI.M34 and, therefore, are acceptable.

<u>Operating Experience</u>. LRA Section B.2.20 summarizes operating experience related to the Buried Piping and Tanks Inspection Program. The applicant stated that the Buried Piping and Tanks Inspection Program is a new program and as such, there is no operating experience to validate the effectiveness of the program. The applicant also stated that recent industry operating experience has been reviewed for applicability, more recent operating experience is captured through the normal operating experience review process where it is screened for applicability, and this process will continue through the period of extended operation. The applicant further stated that buried piping leaks had occurred in its fire protection system, but upon evaluation it was determined that the cause was not age-related degradation.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

Because there have been a number of a recent industry events involving leakage from buried or underground piping, the staff required further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping and Tanks Inspection Program. By letter dated July 8, 2010, the staff issued RAI B.2.22-2 requesting that the applicant provide information regarding how it will incorporate the recent industry operating experience into its AMRs and AMPs.

In its response dated August 9, 2010, the applicant stated that:

- The only corrosion that has occurred in its buried piping was located at the ground to air interface although the applicant did not state a cause for this leak.

- Buried pipe is exposed to non-aggressive soil conditions, the power block was constructed on an elevated berm approximately 20 feet above the original grade and thus most of the buried pipe is located above the water table, and construction specifications controlled the quality of the backfill such that damage to pipe or pipe coatings is not anticipated.

- The buried fuel oil storage tanks and piping in the condensate system and emergency feedwater system is cathodically protected, although for the 2004–2008 time frame, the condensate system and emergency feedwater system cathodic protection was not regularly monitored or maintained and troubleshooting is ongoing to restore this portion of protection.

- Numerous recent inspections have found no degradation of coatings or piping.

- The only in-scope underground piping is one vault each for the condensate and emergency feedwater systems containing one valve and attached piping. The applicant also stated the External Surfaces Monitoring and Structures Monitoring programs include periodic inspections of these vaults. The applicant further stated that inspections conducted in January 2010 identified no corrosion or degradation within the vaults.

- The fuel oil storage tanks' heads and lower shells are periodically inspected by ultrasonic examinations. The applicant also stated that the 2007 inspections identified no external corrosion.

- Recent inspections of fire protection piping found the external surfaces to be in good condition. The applicant also stated that a recent inspection of a portion of emergency feedwater piping found the protective wrapping in good condition and no corrosion was present.

- Most of the nuclear service and decay heat sea water system was constructed underwater and is 20 feet below mean sea level. The applicant also stated that it will use inspections from the interior of the pipe wall to determine its condition.

- The Structures Monitoring Program uses opportunistic inspections to detect degradation of below-grade concrete piping.

Based on its review, the staff determined that it does not have sufficient information to find the applicant's response acceptable. By letter dated November 8, 2010, the staff issued follow-up RAI B.2.22-3 requesting that the applicant: (1) state the cause of the piping degradation at the ground-to-air interface, (2) state the minimum number of excavated direct visual inspections by material and code/safety-related piping and potential to contain hazardous material (i.e., material which, if released, could be detrimental to the environment such as diesel fuel and radioisotopes that exceed the U.S. Environmental Protection Agency (EPA) drinking water standards) category of piping that will be conducted in each of the three 10-year periods starting 10 years prior to the period of extended operation, (3) state the as-found condition of backfill based on recent excavations, (4) justify why the minimum design wall thickness will be maintained throughout the period of extended operation including the projected amount of degradation that could have occurred and is occurring due to the degraded condition of the cathodic protection system for the condensate system and emergency feedwater system, (5) justify alternative internal inspection methods beyond ultrasonic examination, (6) state the frequency of buried tank inspections and justify how UTs of the tank heads and lower shells provide sufficient information to evaluate the condition of all external surfaces of the tank, and (7) state the availability of the cathodic protection system and whether annual ground potential surveys will be conducted.

Pending the applicant's response to, and the staff's review of, the aforementioned RAI, the staff is not able to confirm that the Buried Piping and Tanks Inspection Program is suitably informed by the recent relevant operating experience. This item has been identified as **OI-3.0.3.1.10-1.**

FSAR Supplement. LRA Section A.1.1.20 provides the FSAR supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2. The staff also notes that the applicant committed (Commitment No. 15) to implement the new Buried Piping and Tanks Inspection Program prior to entering the period of extended operation for managing aging of applicable components. During its audit, the staff confirmed that preventive coatings were installed on the piping consistent with GALL Report recommendations.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Buried Piping and Tanks Inspection Program, the staff finds all program elements, pending resolution of OI–3.0.3.1.10–1, consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 Compressed Air Monitoring Program

Summary of Technical Information in the Application. By letter dated November 12, 2010, the applicant submitted LRA Amendment No. 13 which amended the LRA to include Section B.2.21 which describes the existing Compressed Air Monitoring Program as consistent with GALL AMP XI.M24. The applicant stated that the program ensures that instrument air supplied to components is maintained free of water and significant contaminants, thereby preserving an environment that is not conducive to loss of material. The applicant also stated that this program consists of periodic checks of dew point and particulate contamination to verify instrument air quality. The applicant further stated that periodic and opportunistic inspections of accessible internal surfaces are performed for signs of corrosion that might indicate a loss of material within the system.

Staff Evaluation. As a result of the staff's review of the LRA, the proposed aging management of compressed air system components was identified as potentially being in conflict with known industry operating experience and the recommendations of the GALL Report. Therefore, by letter dated June 2, 2010, the NRC issued RAI 3.31-53.1 which requested that the applicant clarify whether there are compressed air system components exposed to condensation at CR-3 and how the aging effects on piping and valves within the compressed air system that are exposed to condensation will be managed for loss of material and other potential aging effects.

In its response dated June 21, 2010, the applicant stated that compressed air components downstream of the compressed air system dryers were considered to be in a dry air environment and, therefore, not expected to exhibit aging effects. Historically, as discussed in the references included in GALL AMP XI.M24, aging effects such as a loss of material have been a contributor to compressed air system failures. Furthermore, the lack of air quality sampling and performance monitoring as described in GALL AMP XI.M24 leaves the quality of the dried air downstream of the system dryers in question. Therefore, by letter dated October 14, 2010, the NRC issued RAI 3.31.53-2 which requested that the applicant identify an AMP which will properly manage the loss of material due to general, pitting, and crevice corrosion aging effects for compressed air system related piping, piping components, and piping elements.

In its response dated November 12, 2010, the applicant stated that the potential for age-related corrosion requiring aging management exists since there is a potential for moisture and/or condensation in compressed air system components downstream of the system dryers. As a result, the applicant amended their LRA in Amendment No. 13 to include the Compressed Air Monitoring Program, which relies on monitoring and testing of compressed air quality to preclude the incidence of moisture, and preventive maintenance and opportunistic inspections to verify that loss of material is not occurring.

The applicant identifies the Compressed Air Monitoring Program as being an existing program consistent with GALL AMP XI.M24. However, the staff has not had the opportunity to conduct a review of the applicant's claim of consistency for this newly identified program, and thus the staff's evaluation of the AMP, operating experience and FSAR supplement have been identified as Confirmatory Item (CI) **CI–3.0.3.1.11–1**.

Operating Experience. The applicant identifies the Compressed Air Monitoring Program as being an existing program consistent with GALL AMP XI.M24. However, the staff has not yet had the opportunity to conduct an audit of the applicant's claim of consistency for this newly identified program, and thus the staff's evaluation of the AMP, operating experience and FSAR supplement have been identified as CI–3.0.3.1.11–1.

FSAR Supplement. The applicant identifies the Compressed Air Monitoring Program as being an existing program consistent with GALL AMP XI.M24. However, the staff has not yet had the opportunity to conduct an audit of the applicant's claim of consistency for this newly identified program, and thus the staff's evaluation of the AMP, operating experience and FSAR supplement have been identified as CI–3.0.3.1.11–1.

Conclusion. The applicant identifies the Compressed Air Monitoring Program as being an existing program consistent with GALL AMP XI.M24. However, the staff has not had the opportunity to confirm the applicant's claim of consistency for this newly identified program, and thus the staff's evaluation of the AMP, operating experience and FSAR supplement have been identified as CI–3.0.3.1.11–1.

3.0.3.1.12 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Technical Information in the Application. LRA Section B.2.23 describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The applicant stated that the program will be implemented using existing preventive maintenance, surveillance testing, and periodic testing work order tasks that will provide opportunities for visual inspection of internal surfaces of piping and ducting components. The applicant also stated that these periodic inspection activities will monitor parameters such as change in material properties, cracking, flow blockage, hardening, loss of material, and reduction of heat transfer effectiveness. The applicant further stated that this program will, in addition to visual inspection of internal surfaces, include a limited scope of preventive maintenance activities that involve physical manipulation or other investigative methods to detect aging effects and inspection of outside surfaces.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M38. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M38, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The GALL AMP XI.M38 "scope of program" program element recommends that the program is applicable to steel components; however, during its audit, the staff found that the applicant's program scope includes materials beyond the scope of the GALL Report recommendations, including stainless steel, aluminum and aluminum alloys, copper and copper alloys, fiberglass or fiber reinforced plastic, elastomers, polyvinyl chloride (PVC) or thermoplastics, gray cast iron, and titanium in a variety of environments. The applicant also expanded the scope of aging effects managed by this program to include cracking due to stress-corrosion cracking (SCC) which is also beyond the scope of the GALL Report recommendations. By letter dated December 1, 2009, the staff issued RAI B.2.23-1 requesting that the applicant provide justification for the expansion in scope of materials to include the additional metallic, elastomer, PVC, and thermoplastic components and the aging effects of cracking due to SCC in metallic materials and hardening and loss of strength in elastomers, PVC, and thermoplastics. In addition, the applicant was requested to identify and justify the inspection techniques used by this program that will be capable of detecting SCC for the metallic materials and hardening and loss of strength in elastomers, PVC, and thermoplastics added to the scope of this program or provide an appropriate program to manage these aging effects.

In its response dated December 30, 2009, the applicant stated that the LRA has been revised to reflect that expansion in scope is an exception to the GALL Report. The applicant also stated the following in relation to inspection techniques:

- The program will use visual examinations to detect discontinuities and imperfections on the surface of the component, as well as non-visual examinations that may include tactile techniques and physical manipulation. The tactile techniques may include scratching, bending, folding, stretching, and pressing of non-metallics, as detailed below, in conjunction with the visual examinations.

- Examination techniques will be appropriate to detect and assess the aging mechanisms of concern and will include visual examination and non-visual examination such as UT or radiography (RT), physical manipulation of elastomers, and investigative methods to determine that hardening and loss of strength is not occurring in non-metallic components.

- As an example, enhanced visual (VT-1 or equivalent) and/or volumetric (RT or UT) testing would be an acceptable means to detect SCC in stainless steel, copper and copper alloys, nickel base alloys, titanium, and aluminum or aluminum alloys.

- Visual examinations to detect age-related degradation of polymers and elastomers would include inspection attributes relevant to degradation of polymers and elastomers, such as cracking, peeling, blistering, chalking, crazing, delamination, flaking, discoloration, physical distortion, gross softening, indications of wear, and loss of material. Tactile techniques for polymers and elastomers would be used and could include scratching the material surface to screen for residues that may indicate a breakdown of the polymer material, bending or folding of the component which may indicate surface cracking, stretching to evaluate resistance of the polymer material, and pressing on the material to evaluate the resiliency.

- Acceptance criteria will be developed for the visual and non-visual examinations and be defined in site procedures. For example, physical manipulation of elastomers could include the attributes of no indication of unacceptable hardening, no delamination, or no unacceptable cracking. For thickness measurements of metals, the remaining wall thickness must be sufficient to provide reasonable assurance that the component will continue to perform its component intended function.

The staff finds this program acceptable because the applicant has revised the LRA to reflect the expansion in scope as an exception and identified appropriate inspection methods for each of the materials. Examples of effective inspection methods include: enhanced visual or volumetric exams to detect SCC cracking in metallic materials; visual and physical manipulation to detect color change, flaking, and peeling in PVC and thermoplastic materials; and physical manipulation of elastomers to detect hardening, cracking, flaking, or gross softening. The staff's concern described in RAI B.2.23-1 is resolved.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements associated with the exception, as a result of amending the LRA, to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. By letter dated December 30, 2009, the applicant amended LRA Section B.2.23 to include an exception to the "scope of the program," "parameters monitored or inspected," and "detection of aging effects" program elements. The exception and staff's evaluation is documented above in RAI B.2.23-1.

Based on its audit and review of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and the applicant's response to RAI B.2.23-1, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the exception to the "scope of the program," "parameters monitored or inspected," and "detection of aging effects" program element, and their justification, and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.23 summarizes operating experience related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant stated that this is a new program for which no operating experience exists for a demonstration of program effectiveness. The applicant also stated that the program will be implemented via existing preventive maintenance, surveillance testing, and periodic testing work order tasks which have been in place at the plant since operation began. The applicant further stated that these tasks have proven effective at maintaining the material condition of SSCs and detecting unsatisfactory conditions. The applicant stated that the operating experience program is an ongoing program and will continue through the period of extended operation by using industry operating experience, historical performance, and vendor recommendations to establish the basis for parameters monitored and inspection intervals under this program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.23 provides the FSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2. The staff also notes that the applicant committed (Commitment No. 18) to implement the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and the applicant's justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 ASME Section XI, Subsection IWE Program

Summary of Technical Information in the Application. LRA Section B.2.25 describes the existing ASME Section XI, Subsection IWE Program as consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE." The applicant stated that the program consists of periodic inspection of Class MC Components of the containment structure and is credited for aging management of metallic liner and integral attachments for the concrete containment, penetration sleeves, personnel airlock and equipment hatch, pressure retaining bolting, and moisture barriers. The applicant also stated that the primary inspection method for the ASME Section XI, Subsection IWE Program is periodic visual examination along with limited volumetric examinations using ultrasonic thickness measurements as needed. The applicant further stated that the program is implemented in accordance with the requirements of ASME Code Section XI, Subsection IWE, 2001 Edition through the 2003 Addenda as modified by of 10 CFR 50.55a.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff confirmed that the ASME Section XI, Subsection IWE Program contains all the elements of the referenced GALL Report program and that the plant conditions are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S1. As discussed in the Audit Report, the staff confirmed that the "preventive action" program element of the LRA AMP was consistent with the corresponding program element of the GALL Report AMP. The "scope of program," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the LRA AMP were not strictly consistent with the corresponding elements of the GALL Report AMP but sufficient information was available to allow the staff to determine that these elements of the LRA AMP are equivalent to the corresponding elements of the GALL Report AMP.

The basis for the staff's determination that the "scope of program," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the LRA AMP are equivalent to the corresponding GALL Report AMP is that the applicant's AMP is based on the 2001 Edition, 2003 Addenda of the ASME Code, while the corresponding elements of the GALL Report use excerpts of the 1995 Edition. The applicant reviewed the elements of its program against the 2001 Edition of the ASME Code, which is referenced in the GALL Report program description. The staff finds this acceptable because it compares the applicant's AMP to their current code edition approved under 10 CFR 50.55a and captures the intent of the GALL Report.

Operating Experience. LRA Section B.2.25 summarizes operating experience related to the ASME Section XI Inservice Inspection, IWE Program. The staff reviewed this information and interviewed the applicant's technical personnel to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently verified that the applicant had adequately incorporated and evaluated operating experience related to this program.

In LRA Section B.2.25, the applicant stated that operating history includes several general visual examinations that were performed on the reactor building (RB) liner plate, penetrations, bolting, and associated attachments. These examinations have identified instances of age-related degradation of the liner plate caused by general and pitting corrosion, general corrosion of penetrations, deterioration of the moisture barrier at the liner/floor interface, deteriorated cork material under the moisture barrier, and liner plate coating degradation. The applicant also stated that corrective actions were taken to assure the intended function of the liner and to repair or replace the degraded components. The moisture barrier was completely removed and the deteriorated cork material below the moisture barrier was replaced. The liner plate was recoated, new cork was installed, and the moisture barrier was replaced. The structural integrity of the RB liner plate was not degraded beyond its design margin. The applicant further stated that the corrosion on the penetrations was evaluated as minor surface corrosion that did not impact the structural integrity of the penetrations. A nuclear condition report (NCR) was initiated to monitor corrosion of the liner during future outages to determine if further compensatory actions need to be taken. In addition, the applicant plans to perform a detailed visual examination of the condition of the moisture barrier at the liner/floor interface in a future outage.

The staff performed an independent search of the plant database for operating experience and noted operating experience related to deterioration of the moisture barrier at the 95 foot elevation in the RB. Liner plate thickness at this elevation measured in 1997 in one area at the liner to moisture barrier interface was 0.307 inch. Nominal measured thickness at this location is 0.390 inch (21 percent reduction in thickness). Therefore, in RAI B.2.25-1 issued by letter dated September 11, 2009, the staff requested that the applicant identify if the degraded area that was subjected to accelerated corrosion has been UT examined in the successive outages since 1997 as recommended in ASME Code Section XI, Subsection IWE-1241 and Table IWE-2500-1 for augmented inspection.

By letter dated October 13, 2009, the applicant responded to RAI B.2.25-1 and stated that the degraded area at the liner to moisture barrier interface that was UT examined in 1997 was not designated as a surface area requiring augmented examination in accordance with ASME Code Section XI, Subsection IWE-1241. There have been no additional inspections of the degraded area since 1997. The applicant stated that one area had a measured pit depth of 0.065 inch with a remaining wall thickness of 0.307 inch at an area of the liner with a UT thickness reading of 0.372 inch. The applicant further stated that its engineering review determined that the reduction in cross sectional area of the liner was negligible with respect to the calculated stress and the ultimate stress, and the overall stress level in the liner plate was insignificant. This was the only area which was less than minimum design thickness. In addition, the applicant stated that at the time of discovery of the degradation in 1997, CR-3 had not developed an ASME Code Section XI, Subsections IWE or IWL inspection program.

In order to complete its review, the staff required additional information. By letter dated December 1, 2009, the staff issued RAI B.2.25-1.1 requesting that the applicant explain why the degraded area of the liner plate was not designated for augmented inspection even after the ASME Section XI, Subsection IWE Program was implemented at CR-3 in 1997 since the pit due to corrosion at the subject area was 0.065 inch or 17.5 percent of the liner plate thickness. ASME Code Section XI, Subsection IWE requires augmented inspection if the base metal thickness is reduced by greater than 10 percent. The staff also requested the applicant provide plans for inspecting the subject area during the current and future refueling outages.

In response to RAI B.2.25-1.1, dated December 30, 2009, the applicant stated that at the time of discovery in 1997, CR-3 had not yet developed an ASME Code Section XI, Subsection IWE or IWL inspection program. An engineering evaluation was performed which determined the small cross sectional area of the pit would not significantly affect the overall stress in the liner plate. Following the development and implementation of the ASME Code Section XI, Subsections IWE and IWL inspection programs in 1999, the area in question was not noted during the ASME Code Section XI, Subsections IWE examinations performed as it is located below the moisture barrier and is not accessible or visible. Since this area was not identified during the ASME Code Section XI, Subsections IWE examinations, it was not scheduled for an augmented inspection. The applicant further stated that during the 2009 refueling outage, the moisture barrier in the area of question was removed and the degraded area of 1997 located. The metal surface area was then cleaned to bare metal. The pit was measured to be approximately 3/32 inch (0.093 inch) deep. An NCR was initiated to evaluate the condition and a work order generated to weld-repair the liner plate pit back to nominal wall thickness. Following the repair, a work order will be used to manage re-coating the area and re-applying the moisture barrier seal. This area will be considered an augmented inspection area in accordance with IWE-3511 and will be inspected in accordance with the schedule and requirements of ASME Code Section XI, Subsection IWE-2420(b) and Table IWE-2500-1, Examination Category E-C requirements.

The staff finds the responses to RAIs B.2.25-1 and B.2.25-1.1 acceptable because the applicant has re-inspected the degradation identified in 1997, initiated an NCR, plans to repair and recoat the degraded liner, re-apply the moisture barrier, and will perform UT examination during the next inspection periods, as recommended in ASME Code Section XI, Subsection IWE-2420(b), until the UT examination reveals that the area of degradation remains essentially unchanged for the next inspection period.

During the audit, the staff also noted that the moisture barrier at the containment base slab was documented to be degraded starting in 2003. Furthermore, in 2007, the moisture barrier was found to be damaged at 12 locations with lengths of up to 36 inches. The damaged moisture barrier provides a path for water penetration at and below the floor level and can affect the leak tightness of the containment during the period of extended operation. Therefore, in RAI B.2.25-2 issued by letter dated September 11, 2009, the staff requested that the applicant discuss any additional investigation and testing that are planned in addition to the visual examination of the moisture barrier during the 2009 refueling outage to determine the extent of liner plate corrosion at the moisture barrier and wall interface.

By letter dated October 13, 2009, the applicant responded to RAI B.2.25-2 and stated that CR-3 has planned for a full visual examination of the accessible ASME Code Section XI, Subsection IWE components including the accessible wall liner and the moisture barrier in the 2009 refueling outage. In addition, CR-3 will be performing repairs of the degraded moisture barrier as needed to ensure a watertight seal between the concrete and the liner plate. Any areas of corrosion of the liner plate that are unsatisfactory will be further evaluated as to the extent of the degradation and additional corrective actions will be performed. There are no plans to remove the moisture barrier to investigate the condition of the liner plate at the interface point of the liner and the moisture barrier or to remove concrete to inspect the floor liner plate during the 2009 refueling outage.

In order to complete its review, the staff required additional information. Therefore, by letter dated December 1, 2009, the staff issued RAI B.2.25-2.1 requesting that the applicant explain why CR-3 has no plans to remove the moisture barrier to investigate the condition of the liner plate corrosion at the moisture barrier and wall and floor liner plate below moisture barrier since moisture barrier degradation has been documented starting 2003 even after the moisture barrier was reinstalled in 1997. In 2007, the moisture barrier was found to be damaged at 12 locations around the circumference. The damaged moisture barrier provides a path for water penetration which may corrode the liner plate. In addition, in 1997, the liner plate was found to be degraded at a number of locations. There has not been any follow-up examination of the liner plate even though the moisture barrier has been damaged since 2003.

In response to RAI B.2.25-2.1, dated December 30, 2009, the applicant stated that during the ASME Code Section XI, Subsection IWE visual examination of the moisture barrier in the 2009 refueling outage, all areas of the moisture barrier with indications and areas previously identified with degradation since 2003 were removed. The liner plate at each of these areas was inspected. The only location that was determined to have degradation of the liner was the area first seen in 1997 and discussed in the response to RAI B.2.25-1. The exposed liner plate will be cleaned and recoated and new moisture barrier installed to ensure a watertight seal at each of the inspected locations. The applicant further stated that for future ASME Code Section XI, Subsection IWE examinations, the work orders generated to examinations will contain a task to remove the moisture barrier and examine the liner surface for any signs of excessive corrosion and wastage in areas of moisture barrier degradation.

The staff finds the responses to RAIs B.2.25-2 and B.2.25-2.1 acceptable because the applicant has replaced the moisture barrier that was found to be degraded/damaged in 2003 and 2007. In addition, areas of the liner plate that were exposed during inspection/replacement of the moisture barrier will be cleaned and recoated. Furthermore, during future ASME Code Section XI, Subsection IWE inspections, the applicant will remove the moisture barrier and examine liner surfaces for any signs of degradation of moisture barrier or degradation of the liner.

During its search of the CR-3 operating experience database, the staff noted that bulging had been identified in the liner plate at numerous locations. Additional investigation performed by the applicant indicated hollow sounds at the bulge locations, indicating separation of the liner plate from the containment concrete. In addition, numerous failures in the coating for the liner plate were noted. Therefore, by letter dated September 11, 2009, the staff issued RAI B.2.25-3 requesting that the applicant provide details of any testing that has been performed to determine the gap between the liner plate and concrete. The staff also requested details of any analysis performed to determine whether the separation of the liner is acceptable during all design basis loading conditions during the period of extended operation. In addition, the applicant was requested to provide information about any AMP that is used to monitor the containment liner plate coating degradation during the period of extended operation and provide justification if no AMP is used to monitor the containment liner plate coating for degradation.

By letter dated October 13, 2009, the applicant responded to RAI B.2.25-3 and stated that there has been no testing to determine the gaps between the liner plate and concrete. Bulges or indications of bulges determined through tapping are identified on inspection datasheets. These coated areas were visually inspected for corrosion and representative UT performed to determine if the liner plate thickness met the minimum design thickness. The applicant further stated that during the refueling outage in 2007, 28 bulges in the liner plate at various locations were identified during the general visual examination. Two of the bulged areas were 12 inches by 36 inches, one was 12 inches by 24 inches, and the remainder were all 12 inches by 12 inches. Each of these locations had a detailed visual examination performed. The coating was satisfactory and there was no rust or deterioration of the bulged liner plate identified. Three of the areas were selected for further evaluation for determination of thickness by UT. Average thickness readings for the four quadrants of each bulged area ranged between 0.358 inch and 0.371 inch, which is well above the minimum design thickness of 0.312 inch. Since the areas that were tested were representative of all the bulged areas and met all requirements, no further UT was performed. It was determined that the areas were minor in nature and did not adversely affect the structural integrity of the RB or its capability to perform its intended function over the next refueling cycle. These areas will continue to be visually inspected in accordance with ASME Code Section XI, Subsection IWE requirements.

In order to complete its review, the staff required additional information. Therefore, by letter dated December 1, 2009, the staff issued RAI B.2.25-3.1 requesting that the applicant explain in detail the basis of its determination that 28 bulges in the liner plate did not adversely affect the structural integrity of the RB. Specifically, the analysis/review that was performed to conclude that the liner plate bulged area of 12 inches by 36 inches, with no contact with concrete, would be able to resist the design loads during a design basis accident condition.

In response to RAI B.2.25-3.1, dated December 30, 2009, the applicant stated that during the 2009 refueling outage, an ASME Section XI, Subsection IWE Program examination was performed on the accessible RB liner plate. In addition to bulges of the liner plate previously identified in 2007, additional bulges were identified during the fall 2009. The applicant further stated that an NCR has been initiated and will be evaluated by the applicant prior to acceptance of the liner plate with the identified liner plate areas which are bulged. The applicant also stated that examination, corrective measures, or repair/replacement activity will be performed in accordance with ASME Code Section XI, Subsection IWE-3122. The details and basis of this engineering evaluation or analysis will be available for the staff's review prior to return to operation of CR-3 from the fall 2009 refueling outage.

The staff finds the response to RAI B.2.25-3.1 acceptable because the applicant has initiated an NCR which will be evaluated and dispositioned in accordance with the approved plant procedures. Any examinations, corrective actions, and repair/replacement activities will be performed in accordance with the ASME Code. To ensure the long term impacts of the bulges are appropriately addressed during the period of extended operation, by letter dated November 8, 2010, the staff issued RAI B.2.25-6 requesting the applicant explain how the bulges will affect the ability of the liner plate to perform its intended function during the period of extended operation. This issue is being tracked as part of the generic OI related to the containment delamination, **OI-3.5-1**.

In response to RAI B.2.25-3, the applicant also stated that the containment liner plate is monitored for corrosion or degraded protective coatings by the ASME Section X1, Subsection IWE Program as stated in LRA Section 3.5.2.2.1.4. In addition, LRA Section 2.1.3, "Generic Safety Issues," discussed GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance," and stated that CR-3 does not credit coatings to assure that the intended functions of coated SCs are maintained. The applicant further stated that the basis for inspecting damage to the coating is that CR-3 meets the requirements of ASME Code Section XI, Subsection IWE, paragraph 2310, which states, "[P]ainted or coated areas shall be examined for evidence of flaking, blistering, peeling, discoloration, and other signs of distress." CR-3 also meets the acceptance standards of ASME Code Section XI, Subsection IWE 3510.2, "Visual Examination of Coated and Non-coated Areas."

The staff reviewed the applicant's response to RAI B.2.25-3 concerning the protective coatings and also noted that LRA Table B-1, "[C]orrelation of NUREG-1801 and CR-3 Aging

Management Programs," item XI.S8 does not include information regarding proper maintenance of protective coatings inside containment. Proper maintenance of protective coatings inside containment (defined as Service Level I coating in Regulatory Guide (RG) 1.54, Revision 1) is essential to ensure operability of post-accident safety systems that rely on water recycled through the containment sump/drain system. Degradation of coatings can lead to clogging of strainers, which reduces flow through the sump/drain system. Therefore, by letter dated September 2, 2009, the staff issued RAI XI.S8 requesting that the applicant provide details on the protective coatings program to provide adequate assurance that there is proper maintenance of the Service Level I coating in containment, such that they will not degrade and become a debris source that may challenge the ECCS.

By letter dated October 2, 2009, the applicant responded to RAI XI.S8 and provided supplemental information regarding the maintenance of protective coatings in containment. The applicant stated that the CR-3 safety-related coatings and the ASME Section XI, Subsection IWE Containment Inspection Programs ensure that there will be proper maintenance of the protective coatings inside containment such that they will not become a debris source that would impact the operability of post-accident safety systems. The safety-related coatings program primarily ensures that protective coatings inside the reactor building do not adversely impact the function of the ECCS. The applicant performs this by maintaining the quantity of unqualified or degraded coatings with the potential to be transported to the reactor building sump below the design limit for clogging the ECCS suction strainer.

The applicant further stated that the quantity of coatings inside the containment is determined by containment inspections and engineering evaluations. The scope of the ASME Section XI, Subsection IWE Program includes inspections of coatings on the reactor building liner plate, penetrations, hatches, etc. The safety-related coatings program includes inspections performed every refueling outage and the ASME Section XI, Subsection IWE Program based inspections are performed once every three refueling outages or every 10 years. The applicant also stated that the specific acceptance criteria for the safety-related coatings include lack of blistering, cracking, flaking, rusting, checking, insufficient adhesion, and undercutting in accordance with various ASTM standards.

In response to RAI XI.S8, the applicant stated the following is done to maintain sump margin:

> Actions to maintain acceptable sump margin include procedural controls to prevent the addition of unqualified/degraded coatings into the containment structure and maintenance activities to remove unqualified/degraded coatings that are already present.

The applicant stated that the safety-related coatings program assessment inspections are performed by qualified safety-related coatings program managers or qualified coating inspectors. The managers are qualified to specific Progress Energy Training Guides within the INPO-accredited Engineering Support Personnel Training Program. The ASME Code Section XI, Subsection IWE component inspections within the reactor building are performed by personnel qualified in accordance with ASME Boiler and Pressure Vessel (B&PV) Code.

In FSAR Table 1-3, "Crystal River Unit 3 Quality Program Commitments," Revision 29.1, the applicant stated that the program for protective coatings continues to meet the requirements of American National Standards Institute (ANSI) N101.4-1972 with clarifications delineated in the FSAR. All inspections are performed by Quality Control Inspectors who are qualified to ANSI N45.2.6-1978. In the FSAR table, the applicant also stated the following:

> The painting specifications delineated in the Program [protective coatings program] will ensure that all protective coatings used inside the primary containment will be proper coatings, applied by qualified personnel and in accordance with manufacturers' instructions, and will be inspected and have proper documentation. This program will meet the intent of Regulatory Guide 1.54, Revision 0 [Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants].

The staff evaluated the information provided by the applicant and determined that the application of the safety-related coatings program and the ASME Section XI, Subsection IWE Program is acceptable in managing coating degradation since the programs are consistent with GALL AMP XI.S8. The staff finds the frequency of coating inspections in the reactor building to be acceptable since inspecting every refueling outage would provide adequate assurance that there is proper maintenance of the protective coatings. The method of performing the coatings inspection is acceptable since the staff has found acceptable that visual inspections are performed and are able to detect adverse coating conditions such as blistering, cracking, flaking, rusting, checking, insufficient adhesion, undercutting, peeling, and other signs of distress. The staff has also found acceptable the manner in which the programs meet the requirements of ANSI N101.4-1972, with additional clarifications found in the FSAR, since it is consistent with RG 1.54, Revision 0. In addition, the qualification of personnel who perform the inspection is found to be acceptable since the staff has reviewed and confirmed that ANSI N45.2.6-1978 is acceptable. Therefore, the staff's concern in RAI XI.S8 is resolved.

During the staff's review of the license renewal application, the applicant notified the NRC of a delamination in the concrete of the containment structure. The event was reviewed by a NRC Special Inspection Team, and the impacts of the event on license renewal are being reviewed by the staff. More information on the details of the event can be found in SER Section 3.0.3.1.14 (ASME Section XI, Subsection IWL Program).

Since October 8, 2009, when the containment delamination was identified, a large number of prestressing tendons have been de-tensioned and concrete has been removed in several locations. During the investigation and repair, vertical through-wall cracks were also identified in the containment. These conditions may have introduced moisture to the liner plate surface and allowed corrosion to form. To address this issue, by letter dated November 8, 2010, the staff issued RAI B.2.25-5 requesting the applicant explain how potential effects of possible long term moisture exposure on the liner will be captured and addressed during the period of extended operation. Currently this issue is being tracked as part of the generic Open Item related to the containment delamination, **OI-3.5-1**.

Based on its review, pending successful resolution of OI-3.5-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of this program has resulted in the applicant taking corrective actions. Therefore, the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and the staff finds it acceptable.

FSAR Supplement. In LRA Section A1.1.25, the applicant provided the FSAR supplement for the ASME Section XI, Subsection IWE Program. The staff notes that the FSAR supplement description of the ASME Section XI, Subsection IWE Program conforms to the recommended FSAR supplement for this type of program as described in SRP-LR Table 3.5-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's ASME Section XI, Subsection IWE Program, including the applicant's responses to RAIs, and pending successful resolution of OI-3.5-1, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 ASME Section XI, Subsection IWL Program

Summary of Technical Information in the Application. LRA Section B.2.26 describes the existing ASME Section XI, Subsection IWL Program as consistent with GALL AMP XI.S2, "ASME Section XI, Subsection IWL." The applicant stated that the program is implemented in accordance with 10 CFR 50.55a and ASME Code Section XI, Subsection IWL, 2001 Edition, through the 2003 Addenda, and manages the reinforced concrete and un-bonded post-tensioning system of the CR-3 Class CC containment structure. The applicant further stated that the program requires periodic inspection of the reinforced concrete RB and inspection and testing of a sample of the un-bonded post-tensioning system as specified by ASME Code Section XI, Subsection IWL. The applicant also stated that the program includes ASME Code Section XI, Subsection IWL examination categories L-A, for concrete surfaces, and L-B, for the un-bonded post-tensioning system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff confirmed that the ASME Section XI, Subsection IWL Program contains all the elements of the referenced GALL Report program and that the plant conditions are bounded by the conditions for which the GALL Report was evaluated.

In comparing program elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S2, the staff noted that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.S2, with the exception of the "detection of aging effects" and "acceptance criteria" program elements. For these program elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs B.2.26-3 and B.2.26-4.

GALL AMP XI.S2 recommends that selected areas such as those that indicate suspect conditions and areas surrounding tendon anchorages receive a more rigorous VT-1 or VT-1C examination. During the onsite audit, the staff noted that the applicant's procedures were not clear on these examination requirements. Therefore, by letter dated September 11, 2009, the staff issued RAI B.2.26-4 requesting that the applicant clarify if CR-3 inspects selected areas of concrete that indicate suspect conditions and areas surrounding tendon anchorages consistent with GALL AMP X1.S2.

In its response to RAI B.2.26-4, dated October 13, 2009, the applicant stated that CR-3 performs inspections of selected concrete surfaces that indicate suspect conditions and areas surrounding tendon anchorages by performing "detailed visuals" in accordance with ASME Code Section XI, Subsection IWL Sub-Articles IWL-2510, IWL-2524, and IWL-2310(b). The applicant further stated that this meets the requirements of ASME Code Section XI, Subsection IWL, 2001 Edition through the 2003 Addenda, which is their current code of record. Since GALL AMP XI.S2 includes use of the 2001 Edition through the 2003 Addenda and CR-3 is in compliance with this Code, CR-3 considers this consistent with GALL AMP XI.S2 and not an exception.

The staff finds the applicant's response to RAI B.2.26-4 acceptable because ASME Code Section XI, Subsection IWL has specific requirements for the detailed visual examination performed for suspect conditions and areas surrounding tendon anchorages. This includes mapping of concrete cracks having widths greater than 0.01 inch. The statement about VT-1, VT-1C, VT-3, and VT-3C examinations in the "detection of aging effects" program element of the GALL Report was included in the 1995 Edition of the ASME Code Section XI, Subsection IWL and was later replaced by "general visual" and "detailed visual" examinations in the ASME Code Section XI, Subsection IWE, 2001 Edition including the 2002 and 2003 Addenda.

GALL AMP XI.S2 recommends American Concrete Institute (ACI) 201.1R-77 for identification of concrete degradation. The CR-3 procedures state that ACI 201.1R-69 and R-92 were used in the development of the conditions indicative of degradation of IWL components and different editions of the ACI code is consistent with the GALL Report recommendations. Therefore, in RAI B.2.26-3 issued by letter dated September 11, 2009, the staff requested that the applicant provide justification that use of ACI 201.1R-69 and R-92 editions are consistent with the GALL Report recommendations without any exception.

In response to RAI B.2.26-3, dated October 13, 2009, the applicant stated that CR-3 did use ACI 201.1R-69 and R-92 in the development of the conditions indicative of damage or degradation of ASME Code Section XI, Subsection IWL concrete surfaces. The applicant further stated IWL-2510, "Surface Examination," of ASME Section XI, Subsection IWL, 2001 Edition through the 2003 Addenda to which CR-3 is committed, specifies ACI 201.1 without the year 77 or 92 designated. Therefore, the applicant considers the use of ACI 201.1R-69 and R-92 to be consistent with GALL AMP XI.S2 and not an exception.

The staff reviewed several revisions of ACI.201.1R and found that different editions of this document provide similar guidance for qualitative inspection of concrete degradation. In addition, ASME Code Section XI, Subsection IWL-2510 requires that the concrete inspection be performed by, or under the direction of, the responsible engineer, and ASME Code Section XI, Subsection IWL-2310 and IWL-2524 have specific quantitative requirements for documenting the magnitude and extent of deterioration and distress of suspect concrete surfaces. Therefore, the applicant's response to RAI B.2.26-3 is acceptable.

Based on its review, including the applicant's responses to RAIs B.2.26-3 and B.2.26-4, the staff finds that program elements one through six of the applicant's ASME Section XI, Subsection IWL Program are consistent with the corresponding program elements of GALL AMP XI.S2 and, therefore, acceptable.

Operating Experience. LRA Section B.2.26 summarizes operating experience related to the ASME Section XI, Subsection IWL Program. The staff reviewed this information and interviewed the applicant's technical personnel to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently verified that the applicant had adequately incorporated and evaluated operating experience related to this program.

GALL AMP XI.S2 states that NRC Information Notice (IN) 99-10 described occurrences of degradation in prestressing systems and recommends that the applicant consider the degradation in prestressing systems. The operating experience section of LRA Section B.2.26 states that the IN 99-10 was reviewed for applicability to CR-3, and it was determined that the procedure used to control the tendon surveillance addressed the issues identified in IN 99-10. However, LRA Section B.2.26 does not address the issue of high relaxation of prestressing steel wires at high operating temperature inside the containment which was identified in IN 99-10. The applicant's procedure considers a loss in prestress due to relaxation of steel to be only 2.95 percent at the end of 40 years. IN 99-10 reported a loss of prestress of 15.5 to 20 percent over a 40-year period at an average temperature of 90 °F. Therefore, in RAI B.2.26-1 issued by letter dated September 11, 2009, the staff requested that the applicant explain how the loss of prestress of 2.95 percent due to relaxation of steel was determined and provide details of any test data used for this purpose. In addition, the staff requested the applicant provide details of the informal review performed which determined that trending analysis for group averages is an acceptable method instead of the individual tendon lift-off forces linear regression analysis as recommended in IN 99-10.

In its response to RAI B.2.26-1, dated October 13, 2009, the applicant stated that the original wire relaxation curve, provided by test data from the wire vendor, forms the bases for the wire relaxation value. The applicant further stated that the loss of prestress due to relaxation of steel determined during the original test performed at 68 °F was increased by a factor of 1.47 to account for long term operating temperature of 104 °F. The total loss of prestress due to relaxation of steel at 40 years so determined was 2.95 percent which is significantly less than 15.5 to 20 percent loss reported in IN 99-10. Therefore, by letter dated December 11, 2009, the staff issued follow-up RAI B.2.26-1.1 requesting that the applicant explain in detail the basis for the 1.47 factor that was used for relaxation of prestressing steel due to a long term temperature of 104 °F versus 68 °F or alternately any test data to support this assumption.

In a letter dated December 30, 2009, the applicant responded to RAI B.2.26-1.1 and stated that the 1.47 factor, which was used for relaxation of prestressing steel due to a long term temperature of 104 °F versus 68 °F, was developed based on using the wire relaxation curve in FSAR Figure 5-26 that is based on 68 °F (20 °C) and comparing to a 104 ° F (40 °C) curve. A documented discussion with the Prescon Corporation, the post-tensioning system supplier, stated the curves are parallel. In addition, at 1,000 hours, the 68 °F curve indicates a 0.75 percent relaxation, while the 104 °F curve indicates about 1.1 percent relaxation. Based on this, a ratio of 1.47 was determined by dividing 1.1 percent by 0.75 percent. A CR-3 design calculation documents this methodology.

The staff reviewed the applicant's response to follow-up RAI B.2.26-1.1 regarding the loss of prestress due to long term relaxation of steel and found it acceptable. The applicant has used appropriate methods and test data to determine the loss in prestress due to long term relaxation of steel. According to FSAR Section 5.2.2.3.1, the prestressing steel used at CR-3 has low relaxation properties. The loss due to relaxation at 68 °F for prestressing steel reported in IN 99-10 was 8 percent as compared 1.1 percent for CR-3 steel.

In response to RAI B.2.26-1, the applicant also stated that the details of the informal review of CR-3 tendon history, which was referred to in the operating experience review of the license renewal basis calculation, could not be located. The applicant further stated that the informal review had determined that trending analysis for group averages was an acceptable method instead of the individual tendon lift-off forces linear regression analysis as recommended in IN 99-10. The applicant further stated that the operating experience review discussed earlier methodology used at CR-3 which has been enhanced over time, and for the 30th year tendon surveillance performed in 2007, CR-3 used the individual tendon lift-off force linear regression analysis method described in IN 99-10. The staff finds this acceptable because the enhanced methodology currently used at CR-3 for regression analysis is consistent with that recommended in IN 99-10.

During the onsite audit of the operating experience, the staff noted that, for several prestressing tendon surveillance inspections over the last 20 years at CR-3, the lift-off forces in the hoop prestressing tendons have been consistently found to be lower than the 95 percent predicted values. After the last (eighth) tendon surveillance in 2007, an NCR was issued which required follow-up action to investigate the reason for this discrepancy. Therefore, in RAI B.2.26-2 issued by letter dated September 11, 2009, the staff requested that the applicant provide the status of the investigation for the discrepancy in the actual lift-off and predicted forces for the prestressing tendons since it may affect the structural integrity of CR-3 containment during the period of extended operation.

By letter dated October 13 2009, the applicant responded to RAI B.2.26-2 and stated that the NCR was closed on April 22, 2009, with no additional actions required. The applicant's responsible engineer stated in the closing of the NCR that, while several tendons have demonstrated lower than expected lift-off values leading to adjacent tendons being tested, the end result in all cases thus far has met the acceptance criteria for any overall group. The staff finds the applicant's response acceptable because LRA Section 4.5 shows that even with the lower than expected tendon lift-off forces for horizontal tendons, the level of prestress will remain above the minimum required design value during the period of extended operation. Therefore, the staff's concern described in RAI B.2.26-2 is resolved.

In order to perform a scheduled steam generator replacement, 10 vertical and 17 horizontal CR-3 containment prestressing tendons were de-tensioned in preparation for hydro-demolition of a containment section. During hydro-demolition of the containment concrete in October 2009, a crack was identified in the concrete near the horizontal tendons, approximately 9 inches from the outer surface of the containment, on all four sides of the temporary opening. In addition, during hydro-demolition, water leaked out of the containment concrete at several places some distance away from the edge of the temporary opening. Therefore, the staff issued RAI B.2.25-4, by letter dated October 27, 2009, requesting that the applicant explain how the recent plant-specific operating experience will be incorporated into the ASME Section XI, Subsection IWL and ASME Section XI, Subsection IWE programs and whether or not a plant-specific program is necessary to manage aging of the containment. Specifically, the applicant was requested to include the containment concrete, prestressing tendons, and the containment liner plate in the discussion and identify and explain any changes to the license renewal application based on the recent plant-specific operating experience. The applicant has not yet responded to this RAI. Therefore, this item is tracked as part of **OI-3.5-1.**

During a public meeting held June on 30, 2010 (presentation material available at ADAMS Accession No. ML101940524), the applicant indicated that they plan to do a structural integrity test prior to returning the containment to service. The staff noted that ASME Section XI, IWL 2410 states, "Concrete shall be examined in accordance with IWL-2510 at 1, 3, and 5 years following the completion of the Containment Structural Integrity Test CC-6000 and every 5 years thereafter." Also, ASME Section XI, IWL-2420 states, "Unbonded post-tensioning systems shall be examined in accordance with IWL-2510 at 1, 3, and 5 years following the completion of the containment Structural Integrity Test and 5 years thereafter." The LRA did not address the ASME Section XI, Subsection IWL inspection frequency of 1, 3, and 5 years after the

Containment Structural Integrity Test. To address this concern, by letter dated November 8, 2010, the staff issued RAIs B.2.26-5 and B.2.26-7 requesting specific information about the ASME Section XI, Subsection IWL inspection frequency. During repair of the delaminated concrete, vertical cracks up to 5 mils in width were recorded in the containment; several appear to be through-wall. By letter dated November 8, 2010, the staff issued RAI B.2.26-8 requesting that the applicant explain the effect of the cracks on the containment structure and any plans to inspect or repair the cracks. Currently, all of these issues are being tracked as part of OI-3.5-1, related to the impact of the containment delamination on extended operation.

Based on its review, pending successful resolution of OI-3.5-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and implementation of this program has resulted in the applicant taking corrective actions. Therefore, the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and the staff finds it acceptable

FSAR Supplement. LRA Section A.1.1.26 provides the FSAR supplement for the ASME Section XI, Subsection IWL Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's ASME Section XI, Subsection IWL Program, the staff finds all program elements consistent with the GALL Report pending successful resolution of OI-3.5-1. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.15 ASME Section XI, Subsection IWF Program

Summary of Technical Information in the Application. LRA Section B.2.27 describes the existing ASME Section XI, Subsection IWF Program as consistent with GALL AMP XI.S3, "ASME Section XI, Subsection IWF." The applicant stated that the program provides for visual examination of Class 1, 2, and 3 component supports. The applicant also stated that visual examination is provided in accordance with the requirements of ASME Code Section XI, Subsection IWF, 2001 Edition through the 2003 Addenda, as modified by 10 CFR 50.55a. The ASME Section XI, Subsection IWF Program is credited for the aging management of the supports for ASME Class 1, 2, and 3 piping and components and supports for RCS primary equipment.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

During its audit, the staff noted that the applicant's program basis document states the program includes inspections of the hydraulic snubber attachments to the foundation or supporting structure and inspection of the fasteners of the snubbers to the component and to the snubber anchorage. The staff noted that the inspection requirement is for obvious structural damage, loose or missing components, or corrosion. The staff noted that the pin to pin joint of the hydraulic snubber is normally included within the scope of this program; however, the staff noted that the snubber pin to pin is being monitored under the hydraulic snubber program. The staff reviewed the applicant's procedures and confirmed that the snubber pin to pin is monitored under the hydraulic snubber program. The staff found this to be acceptable because it is consistent with the applicable GALL Report AMPs.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S3. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.S3. Based on its audit, the staff finds that elements one through six of the applicant's ASME Section XI, Subsection IWF Program are consistent with the corresponding program elements of GALL AMP XI.S3 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.27 summarizes operating experience related to the ASME Section XI, Subsection IWF Program. During the audit, the staff reviewed samples of condition reports and interviewed the applicant's technical staff to verify that degraded conditions were properly corrected in a timely fashion. The staff's review confirmed that the plant-specific operating experience did not reveal an adverse trend in program performance or any unacceptable age-related degradation.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects were addressed, and industry and plant-specific operating experience was reviewed by the applicant in this AMP. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found that the applicant's program would be effective in adequately managing the aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.27 provides the FSAR supplement for the ASME Section XI, Subsection IWF Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's ASME Section XI, Subsection IWF Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.16 10 CFR Part 50, Appendix J Program

Summary of Technical Information in the Application. LRA Section B.2.28 describes the existing 10 CFR Part 50, Appendix J Program as consistent with GALL AMP XI.S4, "10 CFR 50, Appendix J." The applicant stated that the program monitors leakage rates through the containment pressure boundary, including penetrations and access openings. The applicant further stated that the containment leak rate tests assure that leakage through the primary containment, and systems and components penetrating primary containment, do not exceed the allowable leakage limits specified within its TSs. Furthermore, corrective actions are taken if leakage rates exceed established administrative limits for individual penetrations or the overall containment pressure boundary. Seals and gaskets are also monitored under the program. The applicant also stated that the 10 CFR 50, Appendix J Program uses the performance-based approach of 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, and includes appropriate guidance from RG 1.163, September 1995, "Performance-Based Containment Leak-Test Program," and NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S4. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.S4. Based on its audit, the staff finds that elements one through six of the applicant's 10 CFR Part 50, Appendix J Program are consistent with the corresponding program elements of GALL AMP XI.S4 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.28 summarizes operating experience related to the 10 CFR Part 50, Appendix J Program. The staff noted that the containment integrated leak rate test (ILRT) was last performed in December 2005 and that the ILRT test results were satisfactory with no corrective or follow-up actions initiated. In addition, the applicant stated that the site operating experience confirms that the local leak rate tests (LLRTs) are effective in identifying and initiating corrective actions for leakage at containment penetrations, including the equipment hatch and air locks, and in confirming the effectiveness of the corrective actions taken. The applicant also cited typical examples of how the plant-specific operating experience is being used to implement the corrective action program. In one case, the applicant stated a containment isolation valve failed the LLRT and was disassembled and inspected. Subsequently the valve disc was replaced and the as-left LLRT was satisfactory. In another case, the applicant stated failure of a LLRT resulted in the valve being repaired during the initial outage and replaced after it failed in the subsequent outage.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit

Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

During its independent search, the staff noted that the applicant's basis documentation states that a TS change may be generated to take credit for ASME Code Section XI, Subsections IWE and IWL examinations for general inspection of the external and exterior surfaces required to be performed prior to a Type A test. By letter dated September 11, 2009, the staff issued RAI B.2.28-1 requesting that the applicant explain how the ASME Code Section XI, Subsections IWE and IWL examinations performed during a period of 10 years can be credited for general inspection required to be performed prior to a Type A Test.

In its response dated October 13, 2009, the applicant stated that it has chosen to use 10 CFR 50, Appendix J, Option B, "Performance-Based Leakage-Test Requirements," for Type A testing. The staff noted that the 10 CFR 50, Appendix J, Type A testing (ILRT) implementing procedure allows the containment general inspection requirements to be met by the visual examinations performed by ASME Code Section XI, Subsection IWE. Furthermore, the inspections performed by ASME Code Section XI, Subsection IWE using VT-3 and VT-1 qualified inspectors are considered equivalent to or better than the general visual inspections performed by engineering personnel, required by 10 CFR 50.55a, Appendix J. The applicant stated that the examinations are performed prior to the ILRT, when the ASME Code Section XI, Subsection IWE examinations and the ILRT are performed during the same refueling outage. The applicant further stated that during outages when an ASME Code Section XI, Subsection IWE inspection is not performed, a separate visual examination may be performed by engineering and documented in accordance with the ILRT implementing procedure.

Based on its review, the staff finds the applicant's response to RAI B.2.28-1 acceptable because the applicant may perform a visual examination of the containment either in accordance with ASME Code Section XI, Subsection IWE requirements or a separate visual examination prior to the ILRT. In addition, NEI Topical Report (TR) 94-01, Revision 2 recommends that these inspections be performed in conjunction or coordinated with the examinations required by ASME Code Section XI, Subsections IWE and IWL, which the staff has previously endorsed the use of NEI TR 94-01, Revision 2 as documented in the staff's SE of TR 94-01 (ADAMS Accession No. ML081140105).

During its audit, the staff noted that the applicant's 10 CFR 50, Appendix J, Type B and C tests are performed using the makeup-flow method. The staff noted that the applicant's onsite documentations state that the makeup-flow method is the NRC preferred method. By letter dated September 11, 2009, the staff issued RAI B.2.28-2 requesting that the applicant provide a justification for using the makeup-flow method and documentation that indicates that the makeup-flow is the NRC preferred method.

In its response dated October 13, 2009, the applicant stated that it has chosen to use Option B for 10 CFR 50, Appendix J testing. The applicant further stated that the makeup-flow method is allowed for Option B testing. The applicant further stated it could not find any basis for the statement in the 10 CFR 50, Appendix J Program license renewal basis document that the makeup-flow method is the NRC preferred method and agreed to remove it from the document.

Based on its review, the staff finds the applicant's response to RAI B.2.28-2 acceptable because: 10 CFR 50, Appendix J recommends the use of RG 1.163 for Option B tests and RG 1.163 endorses the use of ANSI/ANS-56.8-1994 that allows the use of the makeup-flow method for Type A and B tests and the applicant will remove the statement from the 10 CFR 50, Appendix J Program license basis document which had no basis.

During its audit, the staff noted that the containment leakage rate during the 2005 Type A test was two times more than the leakage rate recorded during the previous test performed in 1991. By letter dated September 11, 2009, the staff issued RAI B.2.28-3 requesting that the applicant explain the root cause for the 100 percent increase in the leakage rate between the two successive tests since it may indicate degradation of the containment structural integrity.

In its response dated October 13, 2009, the applicant stated that a root cause analysis has not been performed for the as-found 2005 Type A test (ILRT) since all acceptance criteria was successfully met (leakage rate 0.19566 percent less than 0.25 percent wt/day). The applicant further stated that the test result for 2005 was more closely associated with earlier test results such as in 1983 (leakage rate 0.179 percent) and 1987 (leakage rate 0.147 percent) rather than 1991 (leakage rate 0.1105 percent) and was not considered a trend affecting the structural integrity of the containment. The applicant also stated that the test methodology used for ILRT in 2005 was different from the one used in 1991. In 1991, mass point analysis was used as the credited test method while in 2005 a total-time analysis was used as the credited test method. Either method is allowed per the ILRT plant procedure. The applicant stated the measured leakage rate in 1991 was 0.0962 percent wt/day and in 2005 was 0.0968 percent wt/day, prior to applying penalties, corrections, and savings.

Based on its review, the staff finds the applicant's response to RAI B.2.28-3 acceptable because the leakage rate of the Type A test performed in 2005 was within the plant TS requirements and the increase in the leakage rate in 2005 can be attributed to the different methods used for calculating penalties and the application of confidence interval.

During the staff's review of the license renewal application, the applicant notified the NRC of a delamination in the concrete of the containment structure. The event was reviewed by a NRC Special Inspection Team, and the impacts of the event on license renewal are being reviewed by the staff. More information is provided in SER Section 3.0.3.1.14.

Due to the extent of the repair associated with the containment delamination, including re-tensioning close to 50 percent of the prestressing tendons, the existing Appendix J, Type A historic results may no longer apply, and a 15 year interval may no longer be appropriate between ILRT tests. To address this concern, by letter dated November 8, 2010, the staff issued RAI B.2.28-4 requesting the applicant explain how an acceptable performance history will be established for Type A tests. This issue is being tracked as part of **OI-3.5-1**.

Based on its audit, review of the application, review of the applicant's responses to RAIs B.2.28-1, B.2.28-2, and B.2.28-3, and pending resolution of OI-3.5-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.28 provides the FSAR supplement for the 10 CFR Part 50, Appendix J Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's 10 CFR Part 50, Appendix J Program, pending resolution of OI-3.5-1, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.31 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited for the aging management of cables and connections not included in its EQ program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E1, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

In LRA Section B.2.31, the applicant stated that this is a new program and will be consistent with GALL AMP XI.E1 and that since this is a new program, there is no plant-specific operating experience history. However, the staff noted that in the "detection of aging effects" program element of the applicant's program, it states that plant operating experience is used to determine the plant areas to be inspected. It further states that based on this review of operating experience, the plant areas to be inspected become localized in nature, consisting of a limited area (or subset) of a much larger plant area or zone. The staff noted that the "detection of aging effects" program element of GALL AMP XI.E1 states that a representative sample of accessible electrical cables and connections installed in adverse localized environment should be visually inspected for cable and connection jacket surface anomalies.

The staff required clarification because GALL AMP XI.E1 recommends inspection of cables and connections installed in adverse localized environments while the applicant's program determines the areas to be inspected based on the plant operating experience. By letter dated September 11, 2009, the staff issued RAI B.2.31-1 requesting that the applicant discuss how its program is consistent with the corresponding GALL AMP XI.E1 and how it will envelop electrical cables and connections within the scope of the program.

In its response dated October 13, 2009, the applicant stated that the GALL Report recommends inspection of cables and connections installed in adverse localized environments. Furthermore, an adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable and connection. The applicant also stated that its program uses operating experience to establish where adverse localized environments may exist to determine the plant areas to be inspected. The applicant stated that operating experience covers a wide range of plant-specific documents and industry related guidance and site-specific operating experience includes the use of EQ zone maps, environmental surveys, maintenance records, corrective actions, and conversations with plant personnel to establish where adverse localized environments may exist based on past cable failures, cables that exhibited the effects of aging, areas of localized overheating, hot spots, etc. The applicant further stated that industry guidance documents include EPRI TR-109619 and EPRI TR-1003317 which provide guidance for locating and identifying adverse localized environments and establishing an effective methodology for field walkdowns of cable systems.

The staff finds the applicant's response unacceptable because the applicant proposed to use only operating experience to establish the adverse localized environments. The staff noted that insulation materials used in electrical cables and connections may degrade more rapidly than expected in these adverse localized environments. The staff further noted an adverse localized environment is a condition in limited plant areas that is significantly more severe than the specified service environment for the cable or connection insulation material. Furthermore, a service environment is dependent on the operating specifications provided by the cable manufacturer and the adverse localized environment should be based on the most limiting cable manufacturer specification (temperature, radiation, or moisture) of the cables bounded by this program. The staff noted an adverse variation in environment is significant if it could appreciably increase the rate of aging of a component or have an immediate adverse effect on operability. The staff noted that the most common adverse localized environments are those created by elevated temperature such as areas near steam generators, feedwater heaters, main steam valves, un-insulated or unshielded hot process piping, steam or packing leaks, high-powered incandescent lighting, motor exhaust air vents, areas with equipment that operate at high temperature, areas with inadequate ventilation, etc. The staff noted that electrical cables and connections normally within 3 feet of these sources may be subjected to an adverse localized environment. The staff also noted that adverse localized environments can be identified through plant operating experience reviews, communication with maintenance, operations, and radiation protection personnel, and the use of environmental surveys.

The staff is concerned that solely relying on operating experience alone to identify adverse localized environment may not be adequate. In a letter dated December 1, 2009, the staff issued RAI B.2.31-1.1 requesting that the applicant provide additional technical justification of how using operating experience alone will identify/envelop all adverse localized environments, or clarify how items such as communication with maintenance, operations, and radiation protection personnel and the use of environmental surveys are, or will be, used to identify adverse localized environments.

In its response dated December 30, 2009, the applicant stated that operating experience is a tool, but not the only tool, used by CR-3 to identify adverse localized environments associated with cable and connection inspections for GALL AMP XI.E1. The applicant also stated that in preparing for GALL AMP XI.E1 cable and connection inspections, plant personnel identify adverse localized environments through an integrated approach. This methodology includes the review of EQ zone maps that show radiation levels and temperatures for various plant areas, consultations with plant staff that are cognizant of plant conditions, use of infrared thermography to identify hot spots on a real time basis, and the review of relevant plant-specific and industry operating experience. The applicant further stated that through the use of these tools, adverse localized environments are identified and an inspection plan developed that assures cables and connections in these areas are inspected for aging degradation. The staff finds the applicant's response acceptable because the applicant will not solely rely on operating experience to identify adverse localized environments. The applicant will also use other means such as the review of EQ zone maps, consultations with plant staff that are cognizant of plant conditions, and infrared thermography to identify hot spots. The staff's concern in RAI B.2.31.1-1 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.2.31-1 and B.2.31-1.1, the staff finds that elements one through six of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program are consistent with the corresponding program elements of GALL AMP XI.E1 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.31 summarizes operating experience related to the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The applicant stated that its program is a new program with no site-specific operating experience history. However, the applicant stated it considered plant-specific and industry-wide operating experience in the development of this program. The applicant stated that review of plant-specific and industry-wide operating experience ensures that the corresponding GALL Report program will be an effective AMP for the period of extended operation. In addition, the applicant stated that plant-specific operating experience for cables and connections has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site engineering personnel. Furthermore, this effort also included a review of applicable site correspondence (licensee event reports, etc). The applicant further stated that the review of plant-specific and industry-wide operating experience confirms that the operating experience discussed in the corresponding GALL Report program is bounding (i.e., that there is no unique, plant-specific operating experience in addition to that in the GALL Report). The staff noted that in the future, the applicant will capture operating experience through its corrective action and operating experience programs implemented in accordance with Progress Energy corporate procedures. The staff further noted that this ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site. The applicant also stated that the administrative controls that implement the corrective action and operating experience programs are implemented in accordance with its QA program, which is in conformance with 10 CFR Part 50, Appendix B. The staff noted that this process will verify that all electrical programs credited for license renewal will continue to be effective in the management of aging effects.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs during the extended period of operation and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.31 provides the FSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 21) by letter dated December 16, 2008, to implement the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program prior to entering the period of extended operation.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.18 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Summary of Technical Information in the Application. LRA Section B.2.32 describes the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program as consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." The applicant stated that this program is credited for the aging management of radiation monitoring and nuclear instrumentation cables not included in the CR-3 EQ program.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E2. As discussed in the audit report, the staff confirmed that each element of the applicant's program were consistent with the corresponding elements of GALL AMP XI.E2, with the exception of the "detection of aging effects" element.

Sufficient information was not available to determine whether the "detection of aging effects" program element of the AMP was consistent with the corresponding element of the GALL Report AMP. In order to obtain the information necessary to verify whether the LRA "detection of aging effects" program element is consistent with the corresponding elements of the GALL Report AMP, in a letter dated September 11, 2009, the staff issued RAI B.2.32-1.

In LRA Section B.2.32, the applicant stated that this is a new program and will be consistent with GALL AMP XI.E2. Under the "detection of aging effects" paragraph of the basis document (L08-0641), the applicant stated that, as an alternate to the review of calibration or surveillance results, CR-3 will test the cable system used in the power range (PR) circuits of the Excore monitoring system. In the corresponding GALL Report AMP program element, it states that in cases where a calibration or surveillance program does not include the cable system in the testing circuit, the applicant will perform cable system testing for detecting deterioration of the insulation system. Since the cable system of PR circuits used in the Excore monitoring system is disconnected during the calibration or surveillance procedures, the cable systems of these systems should be tested and should not be considered as an option or an alternate to calibration or surveillance. The wording "as an alternate to the review of calibration or surveillance" could mean that the applicant could perform either a calibration or test of these cable systems. This is not consistent with GALL AMP XI.E2.

In response to the staff's request, in a letter dated October 13, 2009, the applicant stated that:

> LRA Appendix A, Section A. 1.1.32, and Appendix B, Section B.2.32, specifically state that the power range cable systems used in the Excore Monitoring System will be tested, which is consistent with GALL AMP XI.E2. The CR-3 basis document L06-0641, License Renewal Aging Management Program Description of Electrical and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, in the discussion of the GALL element "Detection of Aging Effects" specifically requires testing of the power range cables. L06-0641 provides the basis for LRA Appendix A, Section A.1.1.32, and Appendix B, Section B.2.32.

The staff finds the applicant's response acceptable because the applicant will test the cable system used in the excore monitoring system since these cable systems are disconnected during the calibration or surveillance procedures. This is consistent with GALL AMP XI.E2 which states that in cases where a calibration program does not include cabling systems in the testing circuit, or as an alternate to the review of calibration results, the applicant will perform cable system testing. The staff's concern described in RAI B.2.32-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.2.32-1, the staff finds that elements one through six of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program are consistent with the corresponding program elements of GALL AMP XI.E2 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.32 states that this program is a new program with no site-specific operating experience history. However, the applicant considered plant-specific and industry-wide operating experience in the development of this program. The applicant stated that review of plant-specific and industry-wide operating experience ensures that the corresponding GALL Report AMP will be an effective AMP for the period of extended operation. In addition, the applicant stated that plant-specific operating experience for cables and connections has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site engineering personnel. This effort also included a review of applicable site correspondence (licensee event reports, etc). The applicant further stated that the review of plant-specific and industry-wide operating experience confirms that the operating experience discussed in the corresponding GALL Report AMP is bounding (i.e., that there is no unique, plant-specific operating experience in addition to that in the GALL Report). Going forward, the applicant will capture operating experience through the CR-3 corrective action and operating experience programs implemented in accordance with corporate procedures. This ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site. The applicant also stated that the administrative controls that implement the corrective action and operating experience programs are implemented in accordance with the CR-3 QA program, which is in conformance with 10 CFR Part 50, Appendix B. This process will verify that all electrical programs credited for license renewal will continue to be effective in the management of aging effects.

The staff conducted an independent search of the applicant's condition report database for operating experience relevant to the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. The staff confirmed that the operating experience described in the applicant's basis document adequately addresses the plant-specific operating experience for this AMP.

The staff also confirmed that the aging effects are bounded by those identified in GALL AMP XI.E2. Therefore, the staff determines that the applicant has adequately addressed this element. The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

FSAR Supplement. In LRA Section A.1.1.32, the applicant provided the FSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program. The applicant committed to implement this AMP prior to the period of extended operation and identified it as LRA Commitment No. 22.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.19 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.33 describes the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that in-scope medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years. The applicant also stated that the specific type of test performed will be determined prior to the initial test and is to be a proven test for detecting deterioration of the insulation system due to wetting. Such testing would include power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed. The applicant defined significant moisture as periodic exposures that last more than a few days (e.g., cables in standing water). The applicant defined significant voltage exposure as being subject to system voltage for more than 25 percent of the time. Further, the applicant stated that manholes associated with inaccessible medium-voltage cables will be inspected for water accumulation and drained as needed. The applicant stated that the manhole inspection frequency will be based on actual field data and shall not exceed 2 years and that the first test and inspections for license renewal will be completed before the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E3. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.E3. Based on its audit, the staff finds that elements one through six of the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program are consistent with the corresponding program elements of GALL AMP XI.E3 and, therefore, are acceptable. Subsequent to this determination, the staff identified concerns with four of these elements based on the applicant's response to RAI B.2.33-1, as descreibed under "Operating Experience."

Operating Experience. LRA Section B.2.33 summarizes operating experience related to the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff also audited operating experience prepared by the applicant and interviewed the applicant's technical staff to confirm that plant-specific operating experience did not reveal any degradation outside the bounds of industry experience. The applicant stated that the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program with no operating history. As stated in LRA Section B.2.33, the applicant did review plant-specific and industry-wide operating experience. The applicant stated that operating experience has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site personnel and site correspondence. The applicant's review of its plant-specific and industry-wide operating experience concluded that there is no unique, plant-specific operating experience in addition to that discussed in the GALL Report.

The “operating experience” program element noted that the applicant’s response to GL 2007-01 identified three related failures of the same offsite power transformer (OPT) cable. The first failure was attributed to a lightning induced voltage surge that failed a conductor splice. Subsequently, a second failure occurred in the same cable but in a different conductor. Based on these failures, the applicant implemented a periodic testing program to identify any subsequent cable degradation. A third failure of a conductor occurred during testing and as a result, the complete circuit was replaced. The applicant determined that these failures were not considered age-related based on the root cause analysis.

The applicant inspected the manholes within the scope of license renewal prior to the staff audit. The applicant noted water in one manhole (E-2) with no cable or raceway submergence noted. A walkdown of in-scope manholes was also performed by the staff. During the staff walkdown, standing water was identified (at a depth of approximately 4 to 6 inches) in manhole E-2. Although water was observed by the staff in the manhole, no cable or raceway submergence was observed by the staff. The staff noted that manholes E-3 and E-7 did not have standing water and that manhole E-7 is equipped with a sump pump with automatic actuation and a high level alarm annunciated in the control room. The staff findings confirmed the applicant’s recent observations. As a result of the inspection, the applicant generated an action request to address the standing water in manhole E-2.

In addition, the staff reviewed the applicant’s current work control program and associated model work orders. These work orders inspect manholes, including the in-scope manholes for license renewal, on an annual basis and perform an operational check of the sump pumps every 6 months. The applicant’s model work order documents whether standing water was found, the level of water, if standing water covered any cables and raceway, and records the volume of water pumped from the manhole.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant’s program would not be effective in adequately managing aging effects during the period of extended operation.

The application of GALL AMP XI.E3 to medium-voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed. However, recently identified industry operating experience indicates that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower service voltages, from 480 volts (V) to 2 kilovolts (kV). Applicable operating experience was identified in licensee responses to GL 2007-01, “Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients,” which included failures of power cables operating at service voltages of less than 2 kV where water was considered a contributing factor. The staff has concluded, based on this recently identified industry operating experience that these cables should be addressed in an AMP. The staff notes that the applicant’s AMP does not address these inaccessible low-voltage power cables.

By letter dated October 14, 2010, the staff issued RAI B.2.33-1 requesting that the applicant:

(1) Provide a summary of its evaluation of recently identified industry operating experience and any plant-specific operating experience concerning inaccessible low-voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 EQ requirements), and how this operating experience applies to the need for additional aging management activities at its plant for such cables.

(2) Provide a discussion of how CR-3 will manage the effects of aging on inaccessible low-voltage power cables within the scope of license renewal and subject to an AMR; with consideration of recently identified industry operating experience and any plant-specific operating experience. The discussion should include assessment of the AMP description, program elements (i.e., "scope of the program," "parameters monitored or inspected," "detection of aging effects," and "corrective actions"), and FSAR summary description to demonstrate reasonable assurance that the intended functions of inaccessible low-voltage power cables subject to adverse localized environments will be maintained consistent with the CLB through the period of extended operation.

(3) Provide an evaluation showing that the inaccessible medium-voltage program test and inspection frequencies, including event driven inspections, incorporate recent industry and plant-specific operating experience for both inaccessible low- and medium-voltage cables. Discuss how the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will ensure that future industry-wide and plant-specific operating experience will be incorporated into the program such that inspection and test frequencies may be increased based on test and inspection results.

By letter dated November 12, 2010, the applicant responded to RAI B.2.33-1 and stated that its response to GL 2007-01 identified a failure of a medium-voltage cable believed to be caused by damaged cable insulation resulting from a lightning strike and that no low-voltage (480 V to 2 kV) cable failures were identified. The applicant further stated that there have been no cable failures identified at CR-3 since that submittal.

The applicant stated that plant-specific and industry-wide operating experience was considered in the development of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, including the changes addressed in the applicant's RAI response. Plant-specific operating experience for low-voltage power and medium-voltage cables has been captured by a review of one or more of the following: the corrective action program; system engineering notebooks and System Health Reports; and discussions with site engineering personnel. This effort also included a review of applicable site correspondence (licensee event reports, etc).

The applicant stated that going forward, operating experience will be captured through the CR-3 corrective action and operating experience programs implemented in accordance with corporate procedures. The applicant also stated that this ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site.

The applicant's RAI response identified exceptions to the "scope of program," "parameters monitored/inspected," "detection of aging effects," and "corrective actions" program elements. The staff's evaluation of these exceptions follows.

Scope of Program. The program applies to inaccessible (e.g., in conduit or direct buried) low-voltage (480 V to 2 kV) and medium-voltage cables within the scope of license renewal that are exposed to significant moisture. This is an exception to the program described in the GALL Report which does not address non-EQ, low-voltage power cable insulation within the scope of license renewal. Also, the GALL Report program addresses cables subjected to significant voltage stress; whereas, the CR-3 program does not rely on this aging mechanism.

The staff finds the proposed exception to the "scope of program" program element acceptable because the applicant has appropriately expanded the program scope to include inaccessible low voltage power cables (480 V to 2 kV) and eliminated the criterion of "exposure to significant voltage," consistent with industry operating experience.

Parameters Monitored/Inspected. The program includes testing of in-scope, low-votage power and medium-voltage cables exposed to significant moisture to provide an indication of the condition of the conductor insulation. This is an exception to the program described in the GALL Report which does not address non-EQ, low-voltage power cable insulation within the scope of license renewal.

The staff finds the proposed exception to the "parameters monitored/inspected" program element acceptable because the applicant has appropriately expanded the components to be tested to include inaccessible low voltage power cables.

Detection of Aging Effects. The program involves testing of low-voltage power and medium-voltage cables exposed to significant moisture that are within the scope of this program at least once every 6 years. This is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. A 6-year testing interval will provide three data points during the 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed before the period of extended operation. The inspection for water collection is performed based on actual plant experience with water accumulation in the manhole. However, the inspection frequency will be at least once each year. The first inspection for license renewal is to be completed before the period of extended operation.

The staff finds the proposed exception related to testing of low- and medium-voltage cables exposed to significant moisture acceptable for CR-3 because the proposed 6-year frequency for in-scope low- and medium-voltage cable insulation testing considers plant-specific and industry operating experience. Plant-specific operating experience has not revealed any instances of failures due to aging related effects of inaccessible low- or medium-voltage cable within the scope of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. In addition, the CR-3 corrective action and operating experience programs will continue to evaluate industry and plant-specific operating experience during the period of extended operation.

The staff finds the applicant's proposed approach for inspecting manholes containing inaccessible in-scope power cable annually not acceptable because the applicant's RAI response did not provide an evaluation or justification for not including manhole inspections based on event-driven occurrences such as flooding or heavy rain. Recently identified industry operating experience has shown that flooding or heavy rain could subject cables within the scope of the program to submergence. The staff has determined that event-driven inspections, in addition to a one-year periodic inspection frequency, is a conservative approach and, therefore, should be considered. The staff will address this issue with the applicant and the resolution of this item has been identified as **OI–3.0.3.1.19–1.**

Corrective Actions. Implementation of corrective actions under the program extends to non-EQ, low-voltage power cables within the scope of the program. This is an exception to the program described in the GALL Report.

The staff finds the proposed exception to the "corrective actions" program element acceptable because the applicant has appropriately expanded the scope of the program to include inaccessible low-voltage power cables.

Based on its audit and review of the application, and pending the resolution of OI-3.0.3.1.19-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.33 provides the FSAR supplement for the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 23) to implement the new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program prior to entering the period of extended operation.

In its response to RAI B.2.33-1, the applicant revised LRA Section A.1.1.33 to include inaccessible low-voltage power cables within the scope of license renewal and to remove the significant voltage criterion. LRA Section A.1.1.33 was also revised to include a six-year test interval for cable insulation and a one-year inspection interval for inspection of manholes that contain in-scope cables. The applicant did not include event driven inspections in the FSAR supplement. Therefore, the staff determines that, pending resolution of OI-3.0.3.1.19-1, the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, pending resolution of OI 3.0.3.1.19-1, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement and concludes, pending resolution of OI-3.0.3.1.19-1, that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.20 Metal Enclosed Bus Program

Summary of Technical Information in the Application. LRA Section B.2.34 describes the new Metal Enclosed Bus Program as consistent with GALL AMP XI.E4, "Metal Enclosed Bus Program." The applicant stated that the Metal Enclosed Bus Program is credited for the aging management of metal enclosed buses within the scope of license renewal.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E4. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.E4. Based on its audit, the staff finds that elements one through six of the applicant's Metal Enclosed Bus Program are consistent with the corresponding program elements of GALL AMP XI.E4 and, therefore, are acceptable.

Operating Experience. LRA Section B.2.34 summarizes operating experience related to the Metal Enclosed Bus Program. The applicant stated that its program is a new program with no site-specific operating experience history. However, the applicant stated it considered plant-specific and industry-wide operating experience in the development of this program. The applicant stated that review of plant-specific and industry-wide operating experience ensures that the corresponding GALL Report AMP will be an effective AMP for the period of extended operation. In addition, the applicant stated that plant-specific operating experience for metal enclosed bus has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site engineering personnel. Furthermore, this effort also included a review of applicable site correspondence (licensee event reports, etc). The applicant further stated that the review of plant-specific and industry-wide operating experience confirms that the operating experience discussed in the corresponding GALL Report AMP is bounding (i.e., that there is no unique, plant-specific operating experience in addition to that in the GALL Report). The staff noted that in the future, the applicant will capture operating experience through its corrective action and operating experience programs implemented in accordance with Progress Energy corporate procedures. The staff further noted that this ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site. The applicant also stated that the administrative controls that implement the corrective action and operating experience programs are implemented in accordance with its QA program, which is in conformance with 10 CFR Part 50, Appendix B. The staff noted that this process will verify that all electrical programs credited for license renewal will continue to be effective in the management of aging effects.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating

experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.34 provides the FSAR supplement for the Metal Enclosed Bus Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 24) to implement the new Metal Enclosed Bus Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Metal Enclosed Bus Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.21 Reactor Coolant Pressure Boundary Fatigue Monitoring Program

Summary of Technical Information in the Application. LRA Section B.3.1 describes the existing Reactor Coolant Pressure Boundary Fatigue Monitoring Program as consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The applicant stated that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program has included preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in metal components of the reactor coolant pressure boundary (RCPB). The applicant also stated that it relies on the Reactor Coolant Pressure Boundary Fatigue Monitoring Program to monitor and track significant thermal and pressure transients to prevent the cumulative fatigue usage from exceeding the design limit for the limiting RCPB components. The applicant further stated that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program addresses the effects of the reactor coolant environment on component fatigue life and evaluates the sample locations in accordance with the guidance provided in NUREG/CR-6260. The applicant further stated that the effects of the reactor water environment on fatigue-sensitive locations have been addressed and are managed for the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP X.M1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP X.M1, with the exception of the "preventive actions" and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The staff noted that the applicant's program relies on transient cycle monitoring to evaluate the fatigue usage described in the LRA. However, the staff noted there was no information regarding how the applicant has been, and will be, monitoring the severity of pressure and thermal activities during plant operations. The staff noted that it is essential that all thermal and pressure transients are bounded by the design specifications (including pressure and thermal excursion ranges and temperature rates) for an effective and valid AMP. In RAI B.3.1-1 dated September 11, 2009, the staff requested that the applicant describe the procedures that it uses for tracking thermal transients, confirm that all monitored transients are bounded by the design specifications, and confirm that all transients significant to fatigue effect were continuously monitored since the plant startup.

In its response dated October 13, 2009, the applicant stated that it uses an existing plant procedure to document and evaluate transients and cycles for applicable systems so that the limits imposed by TSs and the FSAR are not exceeded. The applicant also stated that the procedure requires a review of plant operating data and a comparison of each transient to the transients defined in the design specification. The applicant further stated that all partial cycles are recorded as complete cycles, and if an event were to occur that is not bounded, a condition report would be initiated as part of the corrective action program and an evaluation would be performed in accordance with site QA procedures that meet 10 CFR Part 50, Appendix B requirements. The applicant stated that its Reactor Coolant Pressure Boundary Fatigue Monitoring Program has been in place since the issuance of its operating license.

Based on its review, the staff finds the applicant's response to RAI B.3.1-1 acceptable because the applicant has: demonstrated the effectiveness of its Reactor Coolant Pressure Boundary Fatigue Monitoring Program on transient cycle counting with plant procedures that document and evaluate transients and cycles for applicable systems; maintained all transients as being bounded within the design specifications; and confirmed that all transients that cause cyclic strains have been continuously monitored since the issuance of its operating license, which is essential to a cycle-based fatigue management methodology. The staff's concern described in RAI B.3.1-1 is resolved.

The staff noted that LRA Section B.3.1 states that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program will address the effects of the reactor coolant environment on component fatigue life at the sample locations identified in NUREG/CR-6260. It was not clear to the staff whether the effects of the reactor coolant environment on component fatigue life at the sample locations identified in NUREG/CR-6260 have already been implemented in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program at the time of its LRA.

In RAI B.3.1-4 dated September 11, 2009, the staff requested that the applicant confirm that the effects of the reactor coolant environment on component fatigue life, at the sample locations identified in NUREG/CR-6260, have already been implemented in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program at the time of its LRA. If not, the applicant was asked to provide a commitment to enhance the Reactor Coolant Pressure Boundary Fatigue Monitoring Program to monitor the locations identified in NUREG/CR-6260 that are applicable.

In its response dated October 13, 2009, the applicant stated that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, as currently implemented, bounds the locations identified in NUREG/CR-6260.

Based on its review, the staff found the applicant's response to RAI B.3.1-4 acceptable because the applicant confirmed that the effects of the reactor coolant environment on component fatigue life, at the sample locations identified in NUREG/CR-6260, are already addressed in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, and that the program, as currently implemented, bounds the locations identified in NUREG/CR-6260. The staff's concern described in RAI B.3.1-4 is resolved.

The staff noted that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program includes an "alarm limit" feature which will be initiated when transients that cause cyclic strains or loads in any category reach 90 percent of the allowable value. It was not clear to the staff whether this "alarm limit" has already been implemented in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program at the time of its LRA.

In RAI B.3.1-5 dated September 11, 2009, the staff requested that the applicant confirm that this "alarm limit" has already been implemented in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program at the time of its LRA. If not, the applicant was asked to provide a commitment that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program will be enhanced to include this "alarm limit."

In its response dated October 13, 2009, the applicant stated that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, as currently implemented, contains the described "alarm limit."

Based on its review, the staff finds the applicant's response to RAI B.3.1-5 acceptable because the applicant confirmed that the described "alarm limit" is already implemented in the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, and this alarm limit will provide the applicant with sufficient time to initiate corrective actions prior to the cumulative usage factor exceeding the design limit of 1.0. The staff's concern described in RAI B.3.1-5 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.3.1-1, B.3.1-4, and B.3.1-5, the staff finds that elements one through six of the applicant's Reactor Coolant Pressure Boundary Fatigue Monitoring Program are consistent with the corresponding program elements of GALL AMP X.M1 and, therefore, are acceptable.

Operating Experience. LRA Section B.3.1 summarizes operating experience related to the Reactor Coolant Pressure Boundary Fatigue Monitoring Program. The applicant stated that it reviewed the NRC generic communications (INs, Bulletins, GLs, and draft generic communications), the INPO operating experience database, and licensee event reports, but no applicable operating experience items were identified that related to fatigue monitoring or to exceeding fatigue design limits. The applicant also stated that it reviewed reports regarding EPRI "Good Practice" concepts and concluded that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program is consistent with the EPRI "Good Practice" recommendations. The applicant further stated that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program has been effective in documenting transients and cycles on applicable systems and components so that the design limits are not exceeded.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

During its review of the applicant's program basis document, the staff noticed it states that, "high cycle fatigue due to vibration is not germane to fatigue management program focused on tracking cycles and transients related to low cycle fatigue" and concluded that the operating experience on cracking/leaking in South Texas Project Unit 2, Hope Creek, and St. Lucie Unit 2 are not applicable. The staff noted that the applicant did not provide the basis for exclusion of high-cycle fatigue effects, given that high-cycle fatigue can also cause cracking, and that high-cycle fatigue due to flow-induced vibrations is addressed in LRA Section 4.3.1.2 for the RVI components.

In RAI B.3.1-2 dated September 11, 2009, the staff requested that the applicant: (1) provide the basis for the statement, "no applicable operating experience items that relate to fatigue monitoring or to exceeding fatigue design limits;" (2) describe the actions that are still being taken in response to NRC Bulletin 88-08; (3) describe the actions that are still being taken in response to NRC Bulletin 88-11; and (4) provide a basis that high-cycle fatigue can be exempted from the Reactor Coolant Pressure Boundary Fatigue Monitoring Program.

In its response to RAI B.3.1-2, by letter dated October 13, 2009, the applicant stated in response to (1), that the GALL Report is the repository of industry operating experience up to the time the draft was issued for public comment (January 28, 2005). Therefore, the process for reviewing industry operating experience includes the time period from January 2005, up to, and including, the date of the preparation of the basis document. The applicant stated that it reviewed the generic communication documents for the time period indicated in this RAI, including NRC Bulletins, GLs, INs, Regulatory Issue Summary 2008-30, licensee event reports (keyword search for "fatigue"), and INPO operating experience database (keyword search for "fatigue"). The applicant also stated that it has reviewed plant-specific operating experience and the results of these reviews led to the conclusion that there were no operating experience items related to exceeding fatigue design limits.

The applicant stated in response to (2), that the applicable components associated with NRC Bulletin 88-08 are the high-pressure injection (HPI) makeup nozzles and thermal sleeves. The applicant committed to performing augmented inspections on these components to confirm the nozzle and thermal sleeve integrity. The applicant also stated that a description of these inspections is contained in its ISI Program. The staff reviewed LRA Section B.2.1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program," and verified that it has included reports of cracking on HPI nozzles and thermal sleeves, and has taken corrective actions and follow-up actions to confirm the nozzle and thermal sleeve integrity.

The applicant stated in response to (3), that the thermal stratification and insurge/outsurge transients, as identified in NRC Bulletin 88-11, have been included in the fatigue evaluations of the pressurizer and surge line to ensure ASME Code compliance. The applicant provided additional details on NRC Bulletin 88-11 in its response to RAI 4.3.1.6-1. The staff's evaluation of RAI 4.3.1.6-1 is documented in SER Section 4.3.1.6.2.

The applicant stated in response to (4), that high-cycle fatigue is not a concern for license renewal since it would be discovered during the current license period in most cases where systems are frequently operated. The applicant stated that high-cycle fatigue is a design issue and not a license renewal concern. To support its conclusion, the applicant referenced NRC IN 2002-26, "Failure of Steam Dryer Cover Plate after a Recent Power Uprate." The staff noted that based on a licensee evaluation, it was concluded that this fatigue was attributed to vibrations caused by the synchronization of the cover plate resonance frequency, the nozzle chamber standing acoustic wave frequency, and the vortex shedding frequency and that these frequencies are synchronized in a very narrow band of steam flow at or near the steam flow required to reach full power under the power uprate.

Based on its review, the staff finds the applicant's response to RAI B.3.1-2 acceptable because: (1) the GALL Report, Revision 1 provides a major source of information for industry-wide operating experience through January 2005, and a separate operating experience review prior to January 2005 is not needed; (2) the applicant has augmented its ISI Components and Structures Examination Program to include the HPI makeup nozzles and thermal sleeves; (3) the applicant confirmed that the thermal stratification and insurge and outsurge transients, as identified in NRC Bulletin 88-11, have been included in the fatigue evaluations of the pressurizer and surge line to ensure ASME Code compliance; and (4) the applicant's exclusion of the high-cycle fatigue effects from license renewal consideration is based on high-cycle fatigue being a design issue and not age-related degradation, whereas the high-cycle fatigue time-limited aging analysis (TLAA), due to flow-induced vibration of the RVI, has been projected to the end of the period of extended operation. The staff's concern described in RAI B.3.1-2 is resolved.

LRA Section B.3.1 states that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program is developed in accordance with the EPRI "Good Practice" recommendations without providing the details of how this program has incorporated these "Good Practice" recommendations.

In RAI B.3.1-3 dated September 11, 2009, the staff requested that the applicant provide a summary of the EPRI "Good Practice" recommendations (including EPRI report number) and demonstrate that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program is consistent with the "Good Practice" recommendations.

In its response dated October 13, 2009, the applicant stated that the EPRI TR-1012018, "Thermal Fatigue Licensing Basis Monitoring Guideline (MRP-149)," provides guidance for utilities to implement fatigue monitoring that will adequately and economically track the effects of fatigue on significant RCPB components during plant operations, through the current licensing period and the period of extended operation. The applicant stated that this EPRI report has been released as a "good practice" document, in accordance with the NEI 03-08 materials initiative protocol. The applicant also stated that the requirements of NEI's industry initiative on the management of materials issues have been incorporated into its corporate procedures and that the Reactor Coolant Pressure Boundary Fatigue Monitoring Program is in compliance with the EPRI "Good Practice" recommendations. The staff reviewed EPRI TR-1012018, "Thermal Fatigue Licensing Basis Monitoring Guideline (MRP-149)," and confirmed that it contains guidance for implementation of fatigue monitoring to track the effects of fatigue during plant operations, through the current licensing period and through the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.3.1-3 acceptable because the applicant: (1) has demonstrated that its Reactor Coolant Pressure Boundary Fatigue Monitoring Program has incorporated the requirements on the management of materials issues described in the NEI 03-08 materials initiative protocol and (2) EPRI TR-1012018, which is known as the "Good Practice" document, provides guidance for implementation of fatigue monitoring during the current licensing period and through the period of extended operation. The staff's concern described in RAI B.3.1-3 is resolved.

Based on its audit, review of the application, and review of the applicant's responses to RAIs B.3.1-2 and B.3.1-3, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.39 provides the FSAR supplement for the Reactor Coolant Pressure Boundary Fatigue Monitoring Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Coolant Pressure Boundary Fatigue Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.22 Environmental Qualification (EQ) Program

Summary of Technical Information in the Application. LRA Section B.3.2 describes the existing Environmental Qualification (EQ) Program as consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electrical Components." The applicant stated that the Environmental Qualification (EQ) Program manages component thermal, radiation, and cyclic aging through the use of aging analysis based on 10 CFR 50.49(f) qualification methods. The applicant also stated that, as required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Further, the applicant stated that aging evaluations for EQ components that specify a qualification of at least 40 years are considered TLAAs for its license renewal. The applicant stated in LRA Section 4.4 that under 10 CFR 54.21(c)(1)(iii), its Environmental Qualification (EQ) Program is viewed as an AMP for plant license renewal. The applicant also stated that TLAA option (iii), which states that the effects of aging will be adequately managed for the period of extended operation, is chosen and its Environmental (EQ) Program will manage the aging effects of the components associated with the EQ TLAAs.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP X.E1. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP X.E1. Based on its audit, the staff finds that elements one through six of the applicant's Environmental Qualification (EQ) Program are consistent with the corresponding program elements of GALL AMP X.E1 and, therefore, are acceptable.

Operating Experience. LRA Section B.3.2 summarizes operating experience related to the Environmental Qualification (EQ) Program. The applicant stated that operating experience indicates the Environmental Qualification (EQ) Program is effectively implemented and that, where appropriate, corrective actions are identified and implemented to ensure program effectiveness.

LRA Section B.3.2 states that the Environmental Qualification (EQ) Program has been and continues to be subject to periodic internal and external assessments and that administrative controls require periodic formal assessment of the Environmental Qualification (EQ) Program by knowledgeable people from outside of the EQ group. The applicant's current report indicated a yellow status for one Environmental Qualification (EQ) Program health report program evaluation area. The program review area requires a look ahead for two refueling outages and that no EQ preventive maintenance was missed in the last year. The applicant indicated that for this reporting period, the refueling outage look ahead was not complete except for the 2009 refueling outage. The staff noted that this report also identified a corrective action to revise an aging calculation and an action to replace transmitter components in the upcoming 2009 outage as scheduled but not yet completed. The staff noted that the overall results of the program health report indicated "green" except for the above noted evaluation area. Previous program health reports (January 2008, December 2006, and December 2005) were designated as "green" for all designated evaluation areas. The applicant also referenced a formal self-assessment performed in June of 2005. The applicant's procedures require formal assessments of the Environmental Qualification (EQ) Program be performed by individuals outside of the EQ group. These assessments are scheduled at intervals of no greater than 4 calendar years. The self-assessment found the Environmental Qualification (EQ) Program commitments were generally well maintained; the report identified no issues, two weaknesses, and three items for management consideration. Based on the report results, a follow-up assessment was not recommended. The staff noted that the program assessments and a review of applicant action requests also confirm that the applicant evaluates industry issues and operating experience for impact on its Environmental Qualification (EQ) Program.

The staff screened these results and reviewed them for relevance to the Environmental Qualification (EQ) Program in evaluating the adequacy of the applicant's operating experience review and Environmental Qualification (EQ) Program effectiveness. The staff verified that the operating experience described in LRA Section B.3.2 and associated basis documents adequately addresses the plant-specific operating experience for this program and demonstrates that the effects of aging will be adequately managed for the period of extended operation. In addition, the applicant's operating experience program provides assurance that plant and industry operating experience is evaluated and applied as appropriate. The staff finds that the operating experience identified above demonstrates that identification of program weaknesses and corrective actions as part of the Environmental Qualification (EQ) Program provide assurance that the program will remain effective in assuring that equipment is maintained within its qualification basis and qualified life for the period of extended operation.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit

Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.40 provides the FSAR supplement for the Environmental Qualification (EQ) Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 4.4-2.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Environmental Qualification (EQ) Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.23 One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program

Summary of Technical Information in the Application. The original LRA Section B.2.21 described the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program as consistent with GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." The applicant stated that the program was applicable to ASME Code Class 1 small-bore piping less than 4-inch nominal pipe size (NPS). The ASME Code does not require volumetric examination of Class 1 small-bore piping. The applicant also stated the program would manage cracking through the use of volumetric examinations. However, it also stated that the current technology provides no effective, reliable method of performing volumetric examinations of small-bore socket welds. In lieu of volumetric inspections of socket welds, the program would include one-time volumetric examinations of a sample of Class 1 small-bore butt welds. The applicant stated that the program would be implemented and the volumetric inspections would be completed prior to the end of and within the last 5 years of the fourth 10-year ISI interval.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M35. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M35, with the exception of the "detection of aging effects" and "monitoring and trending" program elements. For these elements the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The staff noted that the applicant has experienced cracking in its ASME Class 1 small-bore piping less than 4-inch nominal pipe size (NPS). The staff noted that the program description of GALL AMP XI.M35 states the following:

> This program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping resulting from stress corrosion or thermal and mechanical loading. Should evidence of significant aging be revealed by a one-time inspection or previous operating experience, periodic inspection will be proposed, as managed by a plant-specific AMP.

However, the applicant provided a one-time inspection program which would be implemented prior to the period of extended operation, even though it has experienced cracking in its ASME Class 1 small-bore piping less than 4-inch NPS. The staff noted that the applicant's proposed one-time inspection was not consistent with the recommendations of the GALL Report. The staff further noted that the applicant can provide a technical justification demonstrating that the cracking experienced previously is not related to aging such that the use of a one-time inspection is appropriate, consistent with GALL AMP XI.M35, or provide a plant-specific program that consists of periodic inspections of small-bore piping.

The staff noted that the "monitoring and trending" program element in GALL AMP XI.M35 stated that the sample size would be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations. The staff noted that the applicant did not provide any technical basis to justify its number of samples selected for inspection. By letter dated September 11, 2009, the staff issued RAI B.2.21-1 requesting that the applicant provide information regarding the methodology used in determining the sampling size and locations.

In its response dated October 13, 2009, the applicant stated that the samples and locations selected would be based on its population of welds that are based on the risk-informed inspection program and that the locations selected would be the most susceptible to aging effects.

Based on its review, the staff finds the applicant's response to RAI B.2.21-1 acceptable because the applicant has a selection criterion that is based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of welds, which is consistent with GALL AMP XI.M.35. The staff's concern described in RAI B.2.21-1 is resolved.

The staff noted that the "detection of aging effects" program element in GALL AMP XI.M35 states that for ASME Code Class 1 small-bore piping, volumetric examination is recommended for one-time inspections on selected weld locations to detect cracking. The staff noted that the applicant's program excludes socket welds from volumetric examination and only plans to perform visual inspections. By letter dated September 11, 2009, the staff issued RAI B.2.21-2 requesting that the applicant provide information on addressing aging management of socket welds.

In its response dated October 13, 2009, the applicant cited a previous teleconference transcript between the staff and NEI which indicated that only performing visual examination on socket welds was acceptable. The staff noted that since the GALL Report represents an official staff position and it recommends the use of volumetric examination to detect cracking, the staff finds the applicant's response unacceptable. Subsequently, the staff held a teleconference on October 29, 2009 (as documented in the teleconference summary dated January 4, 2010), to discuss the RAI response and the issues with the applicant. The staff stated that there are two issues it had identified based on the information provided. The first issue the staff noted was the applicant has already experienced cracking in its small-bore piping. The second issue the staff noted was the applicant's proposed inspection methodology of using VT-2 for Class 1 socket welds is not acceptable because the GALL Report recommends volumetric examination.

By letter dated February 2, 2010, the staff issued RAI B.2.21-3 requesting that the applicant justify why periodic inspections are not needed based on CR-3's operating experience.

In its response dated March 3, 2010, the applicant revised its program to perform periodic inspections of Class 1 small-bore piping. The applicant also deleted its One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program because this program is no longer applicable. However, the staff noted that the applicant did not provide a plant-specific program as recommended by the GALL Report. Instead, the applicant revised its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to include an exception to manage the small-bore piping. The staff noted that this is a change to its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, regarding the "scope of program" and "detection of aging effects" program elements. The staff's review of this "exception" and the periodic inspections being performed for ASME Code Class 1 Small-Bore Piping Program is documented in SER Section 3.0.3.1.1.

Operating Experience. The original LRA Section B.2.21 summarized operating experience related to the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program. The staff noted that the applicant's review included its outage examination results during the fourth 10-year ISI interval and the applicant stated that its program activities have been satisfactorily performed.

The staff reviewed the applicant's operating experience basis document for safety significant operating experience relevant to the aging management of ASME Code Class 1, 2, and 3 components. The staff reviewed samples of its ISI examination results and the implementation of its ASME Code repair/replacement. The staff noted that the applicant has relevant operating experience for the ISI program and had taken corrective actions for flaw indications by performing repairs/replacements of the components. The staff also reviewed its operating experience and noted that the applicant has experienced cracking in its Class 1 small-bore piping.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. The staff noted that the operating experience warranted periodic inspections of its small-bore piping. The staff's evaluation of the applicant's proposal to perform periodic inspections is documented in SER Section 3.0.3.1.1.

FSAR Supplement. In the original LRA Section A.1.1.21, the applicant provided the FSAR supplement for the One-Time Inspection of the ASME Code Class 1 Small-Bore Piping Program. As discussed above, the applicant deleted its One-Time Inspection of the ASME Code Class 1 Small-Bore Piping Program. In Amendment No. 10 (enclosure 2 to the May 3, 2010 letter) the applicant deleted LRA Section A.1.1.21. The staff finds this deletion acceptable because the applicant will be managing the aging effects of ASME Code Class 1 small-bore piping with its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff's review of the ASME Code Class 1 Small-Bore Piping Program is documented in SER Section 3.0.3.1.1.

Conclusion. In its letter dated March 3, 2010, the applicant deleted its One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program because this program is no longer applicable. The applicant revised its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to include an exception to manage small-bore piping. The staff's review of this "exception" and the periodic inspections being performed for ASME Code Class 1 small-bore piping is documented in SER Section 3.0.3.1.1.

3.0.3.2 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- Reactor Head Closure Studs Program
- Bolting Integrity Program
- Open-Cycle Cooling Water System Program
- Closed-Cycle Cooling Water System Program
- Inspection of Overhead Heavy Load and Light Load Handling Systems Program
- Fire Protection Program
- Fire Water System Program
- Fuel Oil Chemistry Program
- Reactor Vessel Surveillance Program
- Selective Leaching of Materials Program
- External Surfaces Monitoring Program
- Lubricating Oil Analysis Program
- Masonry Wall Program
- Structures Monitoring Program

- Fuse Holder Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

For AMPs that the applicant claimed are consistent with the GALL Report, with exception(s) and/or enhancement(s), the staff performed an audit and review to confirm that those attributes or features of the program, for which the applicant claimed consistency with the GALL Report, were indeed consistent. The staff also reviewed the exception(s) and/or enhancement(s) to the GALL Report to determine whether they were acceptable and adequate. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.2.3 describes the existing Reactor Head Closure Studs Program as consistent with GALL AMP XI.M3, "Reactor Head Closure Studs," with an enhancement. The applicant stated that this program manages cracking and loss of material for the reactor head closure head assembly that comprises the studs, nuts, and washers that are inspected under the applicant's ISI program. The applicant stated that VT-2 examinations are also conducted to detect evidence of leakage. The applicant further stated this program includes inspections that provide reasonable assurance that the effects of cracking and loss of material would be identified and repaired prior to the loss of intended function.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M3. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M3.

The staff also reviewed the portions of the "preventive actions" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement. LRA Section B.2.3 states an enhancement to the "preventive actions" program element. The applicant stated that an enhancement will be made to select an alternate lubricant that is compatible with the fastener material and the contained fluid.

The staff noted that RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," is one of the technical references for GALL AMP XI.M3 and states the regulatory position that lubricants for the stud bolting are permissible provided they are stable at operating temperatures and are compatible with the bolting and vessel materials and the surrounding environment.

During its audit, the staff noted that a molybdenum disulfide-based lubricant is used for the reactor head closure stud and required clarification as to whether or not this lubricant has caused detrimental effects on the bolting and vessel materials and how the stability of the lubricant at operating temperatures will be considered when selecting a new lubricant, as recommended by RG 1.65.

In RAI B.2.3-1 dated September 11, 2009, the staff requested that the applicant confirm whether or not operating experience indicates that the lubricant currently used has caused detrimental effects on the bolting materials. The staff also requested that the applicant clarify how the stability of the lubricant at operating temperatures will be considered when selecting a new lubricant, as recommended by RG 1.65.

In its response dated October 13, 2009, the applicant confirmed that the inspection reports for the last five outages were reviewed and all the examination results were acceptable. The applicant also confirmed that a lubricant, which does not contain molybdenum disulfide, was selected in the program enhancement and the selected lubricant can be used in applications with a dry surface temperature as high as 2,400 °F. The staff noted that the selected lubricant will remain stable because it has a useable maximum temperature that is significantly higher than the normal operating temperatures of the reactor head closure studs.

Based on its review, the staff finds the applicant’s response to RAI B.2.3-1 and this enhancement acceptable because the applicant’s operating experience has demonstrated that the use of the molybdenum disulfide-based lubricant has not resulted in detrimental effects on the reactor head closure studs, the selected replacement lubricant has no molybdenum disulfide and has a useable maximum temperature that is significantly higher than the normal operating temperatures of the reactor head closure stud,; and the applicant’s selected lubricant is consistent with the recommendations of RG 1.65 and the GALL Report. The staff’s concern described in RAI B.2.3-1 is resolved.

Based on its audit and review of the applicant’s response to RAI B.2.3-1, the staff finds that elements one through six of the applicant’s Reactor Head Closure Studs Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.M3 and, therefore, acceptable.

<u>Operating Experience</u>. LRA Section B.2.3 summarizes operating experience related to the Reactor Head Closure Studs Program. The staff noted that the ISI summary reports for the third interval were reviewed and there have been no aging effects identified that have been attributed to wear or SCC.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant’s program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant’s program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the “operating experience” program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.3 provides the FSAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff also notes that the applicant committed (Commitment No. 3) to enhance the Reactor Head Closure Studs Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program to select an alternate lubricant that is compatible with the fastener material and the contained fluid.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Studs Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No.3, prior to the period of extended operation, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Bolting Integrity Program

Summary of Technical Information in the Application. LRA Section B.2.8 describes the existing Bolting Integrity Program as consistent with GALL AMP XI.M18, "Bolting Integrity," with enhancements. The applicant stated that this program addresses aging management requirements for bolting on mechanical components within the scope of license renewal. The applicant stated that this program relies on the recommendations of NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," and EPRI guidance, such as EPRI TR-104213 and NP-5769. The applicant stated that safety-related bolting and closures inspections, monitoring and trending, and repair/replacements are performed under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M18. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M18.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Enhancement 1. LRA Section B.2.8 states an enhancement to the “scope of program” program element. The applicant stated that an enhancement will be made to include guidance for torquing and closure requirements based on the EPRI guidance documents (TR-104213 and NP-5769). The staff notes that in the “scope of program” program element, GALL AMP XI.M18 recommends the use of EPRI TR-104213 and NP-5769.

Based on its review, the staff finds this enhancement acceptable because the applicant’s enhancement adds torquing and closure requirements, in accordance with the EPRI TR-104213 and NP-5769, and is consistent with the recommendations of the GALL Report.

Enhancement 2. LRA Section B.2.8 states an enhancement to the “preventive actions” program element. The applicant stated that an enhancement will be made to identify and remove instances where a molybdenum disulfide lubricant is allowed for use in specific procedures for bolted connections.

The staff noted that GALL AMP XI.M18 relies on the recommendations for a comprehensive bolting integrity program, as delineated in NUREG-1339, and industry recommendations, as delineated in EPRI NP-5769, with the exceptions noted in NUREG-1339 for safety-related bolting. The staff also noted that NUREG-1339 states that service failures and laboratory examinations show that molybdenum disulfide is a potential contributor to SCC.

The staff finds that the applicant’s enhancement to discontinue the use of a molybdenum disulfide-based lubricant is consistent with the recommendations of the GALL Report. However, the staff required clarification as to whether or not the molybdenum disulfide-based lubricant, which was previously used or is still currently used, has caused detrimental effects on the bolting materials.

In RAI B.2.8-1 dated September 11, 2009, the staff requested that the applicant clarify whether or not the molybdenum disulfide-based lubricant has caused detrimental effects on the bolting materials. The staff also requested the justification from the applicant’s evaluation of the potential detrimental effects, including relevant operating experience.

In its response dated October 13, 2009, the applicant stated that a molybdenum disulfide-based lubricant was maintained in stock and specified in several site procedures as a bolting thread lubricant. The applicant explained that SCC is caused by a combination of susceptible material, stress, and environment so that relevant control of stress in bolting and good housekeeping practices, such as control of boric acid attack, elimination of leakage from borated water systems, and prompt cleanup of any primary water spills, can reduce the possibility of SCC by avoiding the required combination for the occurrence of SCC. In addition, the applicant confirmed that an operating experience review of the bolted connections was performed and did not identify instances of failed bolting or bolted connections attributed to SCC. The staff determined that the molybdenum disulfide-based lubricant has imposed no significant detrimental effects on the bolting and bolted connections, based on the operating experience that no instance of failed bolting or bolted connections due to SCC has been observed. The staff also determines that the applicant’s approach to use leakage control and bolting stress control are adequate preventive measures to prevent or mitigate SCC in bolting and bolted connections.

Based on its review, the staff finds the applicant’s response to RAI B.2.8-1, and this enhancement, acceptable because the applicant’s operating experience review indicates that the molybdenum disulfide-based lubricant has imposed no significant detrimental effects on the bolting and bolted connections, and the applicant will discontinue the use of the molybdenum disulfide-based lubricant, which is consistent with the recommendations of the GALL Report. The staff's concern described in RAI B.2.8-1 is resolved.

Enhancements 3, 4, and 6. LRA Section B.2.8 states an enhancement (Enhancement 3) to the "preventive actions" program element. The applicant stated that an enhancement will be made to include guidance for torquing and closure requirements, which includes proper torquing of bolts and a check for uniformity of gasket compression after assembly.

LRA Section B.2.8 states an enhancement (Enhancement 4) to the "preventive actions" program element. The applicant stated that an enhancement will be made to include guidance for torquing and closure requirements based on the guidance of EPRI NP-5067, "Good Bolting Practices, A Reference Manual for Nuclear Power Plant Personnel," Volumes 1 and 2.

LRA Section B.2.8 also states an enhancement (Enhancement 6) to the "detection of aging effects" program element. The applicant stated that an enhancement will be made to include a centralized procedure based on EPRI NP-5067 and incorporate guidance regarding bolted joint leak tightness and pre-installation inspections consistent with the recommendation of the EPRI document.

The staff noted that GALL AMP XI.M18 references EPRI NP-5769 and EPRI TR-104213 as guidance for industry recommendations. In relation to EPRI NP-5067, the staff noted that EPRI NP-5769 Volume 1, Section 2 (page 2-8) states that, "[T]hese manuals [EPRI NP-5067, Volumes 1 and 2] will serve as a repository of useful information learned from EPRI experimental and analysis programs and will give the utility industry guidelines for bolted joints." EPRI NP-5769 also states that, "It is believed that the bolting reference manuals [EPRI NP-5067, Volumes 1 and 2] will satisfy the industry's need for guidance in this area [which is bolted joints]."

Therefore, the staff finds that the use of EPRI NP-5067 as a guidance document for the Bolting Integrity Program is not in conflict with the recommendations of the technical references of the GALL Report. However, the staff noted that EPRI TR-104213, Section 1.1 states that the development objectives for EPRI TR-104213 were to update and consolidate the existing information, including EPRI NP-5067 and NP-6316, into a single document and to provide additional information necessary to allow a seamless integration of the material. The staff also noted that NUREG-1339 takes some exceptions for safety-related bolting to EPRI NP-5769, such as yield strength criteria for categorization of materials in terms of SCC susceptibility.

In RAI B.2.8-3 dated September 11, 2009, the staff requested that the applicant clarify whether EPRI NP-5769, with the exceptions noted in NUREG-1339 and EPRI TR-104213, will be considered and used as industry recommendations for the applicant's enhancements, as well as EPRI NP-5067 that the applicant is currently planning to use.

In its response dated October 13, 2009, the applicant stated that it will use EPRI NP-5769, with exceptions noted in NUREG-1339 and EPRI TR-104213, in addition to EPRI NP-5067 as technical guidance and basis for this program.

Based on its review, the staff finds the applicant's response to RAI B.2.8-3, and these enhancements, acceptable because it is consistent with the recommendations of the GALL Report. The staff's concern described in RAI B.2.8-3 is resolved.

Enhancements 5 and 7. LRA Section B.2.8 states an enhancement (Enhancement 5) to the "parameters monitored/inspected" program element. The applicant stated that an enhancement will be made to include periodic UT examination of a representative sample that is identified as potentially having yield strength greater than 150 kilopounds per square inch (ksi).

LRA Section B.2.8 also states an enhancement (Enhancement 7) to the "detection of aging effects" program element. The applicant stated that an enhancement will be made to include periodic ultrasonic examination of a representative sample of bolting identified as potentially having yield strength greater than 150 ksi and includes periodic in-situ UT examinations of these bolts for SCC or, alternatively, bolting may be removed for surface examinations or replaced.

The staff noted that GALL AMP XI.M18 states that high-strength, low alloy steel bolting with the actual yield strength greater than or equal to 150 ksi may be subject to SCC. The staff also noted that Section 3 of NUREG-1339 recommends that the yield strength criteria for categorization of bolting material's susceptibility to SCC should be based on actual measured yield strength (e.g., the test data in certified material test reports), or yield strength determined by conversion of measured hardness values, but not be based on the specified minimum yield strength. However, the staff noted, during its audit, that the applicant's onsite program documentation addressed a calculation of the maximum yield strength, using the specified minimum yield strength and specified maximum and minimum tensile strength values in relation to the categorization of bolting material's susceptibility to SCC. The staff noted the applicant's documentation suggested that specified yield and/or tensile strength values may be used to calculate yield strength, which may be used as input for the categorization of bolting material's susceptibility to SCC. Based on this information, the staff required further clarification of the applicant's approach regarding the categorization of bolting material's susceptibility to SCC.

In RAI B.2.8-2 dated September 11, 2009, the staff requested that the applicant describe how the yield strength of the bolting materials will be determined as input for the yield strength criterion to categorize the bolting material's susceptibility to SCC.

In its response dated October 13, 2009, the applicant stated that the categorization of the bolting materials in terms of SCC resistance will be based on actual measured yield strength or yield strength determined by conversion of measured hardness values, in conjunction with the use of the GALL Report recommended yield strength criterion of greater than or equal to 150 ksi. The applicant also stated that in the absence of actual measured yield strength data, bolting specified in the range considered medium strength by NUREG-1339 (i.e., bolting with 120 less than S_y less than 150 ksi) and above, will be assumed to be high-strength bolting. The applicant also stated that sampling sizes for high-strength bolting inspections will be based on methodology in EPRI TR-107514, "Age-Related Degradation Inspection Method and Demonstration: In Behalf of Calvert Cliffs Nuclear Power Plant License Renewal Application."

Based on its review, the staff finds the applicant's response to RAI B.2.8-2, and these enhancements, acceptable because a review of the applicant's operating experience shows no instances of failed bolting or bolted connections due to SCC, which indicates relatively high resistance of the bolting materials to SCC, the applicant will use actual measured yield strength or yield strength determined by conversion of measured hardness values for SCC susceptibility categorization, which is consistent with NUREG-1339 and the GALL Report. Additionally, the applicant's approach in the absence of actual yield strength data can ensure conservative and acceptable sampling for the high-strength bolting inspections to manage the effect of SCC, the in-situ UT examination of the high-strength bolts in the program enhancement is consistent with the GALL Report, the applicant's alternative for in-situ UT examination, to perform surface examinations or replace high-strength bolting that has been removed, will be capable of detecting SCC due to environmental effects on the bolts, and in consideration of the applicant's operating experience with no instance of failed bolting or bolted connections due to SCC, the applicant's sampling for high-strength bolting inspections, which is based on EPRI TR-107514, is acceptable to detect and manage the aging effect of SCC. The staff's concern described in RAI B.2.8-2 is resolved.

Enhancement 8. LRA Section B.2.8 states an enhancement to the "monitoring and trending" program element. The applicant stated that an enhancement will be made to perform the examination of nuclear steam supply system (NSSS) support high-strength bolting for SCC concurrent with examinations of the associated supports, with a minimum frequency of once per 10-year ISI period.

Based on its review, the staff finds this enhancement acceptable because the applicant's enhancement ensures that adequate inspections are performed to manage aging effects of the NSSS support high-strength bolting in a manner consistent with the recommendations of the GALL Report.

Enhancements 9 and 10. LRA Section B.2.8 states two enhancements to the "corrective actions" program element. The applicant stated that an enhancement will be made to include guidance for torquing and closure requirements, based on the recommendations of EPRI NP-5769, and to use the acceptance standards for high-strength structural bolting that are consistent with the recommendations of EPRI NP-5769.

The staff noted that GALL AMP XI.M18 references EPRI NP-5769, which provides industry recommendations for material selection and testing, bolting preload control, evaluation of structural integrity of bolted joints, and other relevant subjects. The staff also noted that the "corrective actions" program element of GALL AMP XI.M18 states that replacement of the ASME Code pressure retaining bolting is performed in accordance with appropriate requirements of the ASME Code Section XI, as subject to additional guidelines and recommendations of EPRI NP-5769.

Based on its review, the staff finds this enhancement acceptable because the applicant's enhancement will include guidance for torquing and closure requirements, based on EPRI NP-5769, and the acceptance standards for high-strength structural bolting, based on EPRI NP-5769, which are consistent with the recommendations of the GALL Report.

Based on its audit and review of the applicant's responses to RAIs B.2.8-1, B.2.8-2, and B.2.8-3, the staff finds that elements one through six of the applicant's Bolting Integrity Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL AMP XI.M18 and, therefore, acceptable.

Operating Experience. LRA Section B.2.8 summarizes operating experience related to the Bolting Integrity Program. The applicant stated that a review of plant-specific operating experience associated with bolting has identified instances of leakage of bolt connections, and the deficiencies noted included use of incorrect gasket material in flange connections and loss of preload resulting from relaxation of heat exchanger joints. The applicant also stated that corrective actions were prescribed, including generic guidance in plant program documents, as appropriate. The staff noted that the applicant took corrective actions.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.8 provides the FSAR supplement for the Bolting Integrity Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, 3.4-2, and 3.5-2.

The staff also notes that the applicant committed (Commitment No. 5) to enhance the Bolting Integrity Program prior to entering the period of extended operation. Specifically, the applicant committed to the following:

- guidance for torquing and closure requirements based on the EPRI documents endorsed by the GALL Report

- requirements to remove instances where molybdenum disulfide lubricant is allowed for use in bolting applications in specific procedures and to add a general prohibition against use of molybdenum disulfide lubricants for bolted connections

- guidance for torquing and closure requirements that include proper torquing of the bolts and checking for uniformity of gasket compression after assembly

- guidance for torquing and closure requirements based on the recommendations of EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants" (with exceptions noted in NUREG-1339); EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide"; and EPRI-5067, "Good Bolting Practices, A Reference Manual for Nuclear Power Plant Personnel," Volumes I and II

- a centralized procedure based on EPRI NP-5769, EPRI TR-104213, and EPRI-5067 containing guidance regarding bolted joint leak tightness and pre-installation inspections consistent with the recommendations of those documents

- periodic examinations of a representative sample of bolting identified as potentially having yield strength greater than or equal to 150 ksi for SCC consisting of periodic in situ UT or, alternatively, surface examination or bolt replacement, with sample sizes based on EPRI TR-107514 methodology

- examination of NSSS support high-strength bolting for SCC concurrent with examinations of the associated supports at least once per 10-year ISI period

- acceptance standards for examination of high-strength structural bolting consistent with the recommendations of EPRI NP-5769 or application-specific structural analyses

The staff determines that the information in the FSAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Bolting Integrity Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 5, prior to the period of extended operation, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.2.10 describes the existing Open-Cycle Cooling Water System Program as being consistent, with enhancements, with GALL AMP XI.M20, "Open-Cycle Cooling Water System." The applicant stated that the program relies on implementation of the recommendations in GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," and its supplement. The applicant also stated that the program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, and silting in the nuclear service and decay heat sea water system or SCs serviced by the open-cycle cooling water system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M20. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding elements of GALL AMP XI.M20, with the exception of the "detection of aging effects" and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff reviewed the applicant's program basis document and noted that the Open-Cycle Cooling Water System Program will be used to detect selective leaching. The selective leaching AMP uses both visual inspection techniques and hardness/scratch tests to identify selective leaching. It was not clear to the staff that the Open-Cycle Cooling Water System Program would adequately detect selective leaching unless it is enhanced to include some form of hardness testing. By letter dated September 11, 2009, the staff issued RAI B.2.10-1 requesting that the applicant include hardness testing for the identification of selective leaching or justify how this aging effect may be identified using the inspection techniques already specified.

In its response dated October 13, 2009, the applicant enhanced the "detection of aging effects" program element of its Open-Cycle Cooling Water System Program to include hardness/scratch testing for selective leaching for susceptible valves and pumps and visual inspection for discoloration followed by hardness testing, if appropriate, for heat exchanger components.

The staff finds the applicant's response acceptable because the applicant committed to include the use of hardness/scratch tests and visual examination, which is consistent with the recommendations in GALL AMP XI.M33, "Selective Leaching of Materials." These inspection methods will detect selective leaching in cast iron and copper alloy materials. The staff's concern described in RAI B.2.10-1 is resolved.

The staff reviewed the applicant's program basis document and noted that the "acceptance criteria" program element should contain information concerning the acceptance criteria against which the need for corrective action will be measured. The SRP-LR states that acceptance criteria should also consist of numerical values or methods by which they are determined. It is not clear to the staff that the LRA AMP will adequately determine the need for further evaluation. By letter dated September 11, 2009, the staff issued RAI B.2.10-2 requesting that the applicant provide acceptance criteria as recommended in the SRP-LR.

In its response dated October 13, 2009, the applicant stated that an enhancement has been added to the "acceptance criteria" program element of the Open-Cycle Cooling Water System Program to provide acceptance criteria for biofouling and the maintenance of protective linings. The applicant also stated that it would add these acceptance criteria to inspection procedures and periodic maintenance instructions. The applicant further stated that these procedures would call for the removal of accumulation of biofouling agents, corrosion products, and silt and that they would call for the detection of defective protective coatings.

The staff finds this response acceptable because the applicant's Commitment No. 6 includes adoption of the acceptance criteria detailed above and those criteria are consistent with GALL AMP XI.M20 and are appropriate for managing the aging under consideration. The staff's concern described in RAI B.2.10-2 is resolved.

The staff also reviewed the portions of the "preventive actions," "detection of aging effects," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.10 states an enhancement to the "preventive actions" program element. This enhancement adds a periodic inspection and rebuild of nuclear services and decay heat sea water system pumps. The applicant stated that this enhancement will take place during the current license period and will ensure that one or more pumps will be inspected prior to the period of extended operation.

The staff notes that the "preventive actions" program element of GALL AMP XI.M20 states that the program includes a condition and performance monitoring program, control and preventive measures, or flushing of infrequently used systems. The applicant stated in LRA Section B.2.10 that this enhancement will add periodic inspection/rebuild program to the nuclear services and decay heat sea water system pumps. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. On the basis of its review, the staff finds that this enhancement is acceptable because the maintenance program enhancement will ensure that loss of material due to crevice, general, microbiologically-influenced, and pitting corrosion and flow blockage will not degrade the performance of the pumps.

Enhancement 2. LRA Section B.2.10 states an enhancement to the "preventive actions" program element. The applicant stated that this enhancement will expand the existing program by adding inspection of the nuclear services and decay heat sea water system discharge conduits prior to the period of extended operation.

The staff notes that the "preventive actions" program element of GALL AMP XI.M20 states the program includes a condition and performance monitoring program, control and preventive measures, or flushing of infrequently used systems. The applicant stated in LRA Section B.2.10 that this enhancement will add inspection and evaluation of the nuclear services and decay heat sea water discharge conduits, subsequent to the steam generator replacement project, but prior to the period of extended operation. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. On the basis of its review, the staff finds that this enhancement is acceptable because the action will ensure that corrosion, erosion, silting, and biofouling will not degrade the performance of the discharge conduits, and the applicant's actions associated with this enhancement considered plant-specific operating experience.

Enhancement 3. LRA Section B.2.10 states an enhancement to the "preventive actions" program element. The applicant stated that this enhancement expands the existing program by adding periodic maintenance activities for expansion joints RWEJ-3 through 10.

The staff notes that the "preventive actions" program element of GALL AMP XI.M20 states that the program includes a condition and performance monitoring program, control and preventive measures, or flushing of infrequently used systems. The applicant stated in LRA Section B.2.10 that this enhancement will add periodic maintenance activities to the nuclear services and decay heat sea water expansion joints RWEJ-3 through 10. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. On the basis of its review, the staff finds that this enhancement is acceptable because the applicant's actions associated with this enhancement will ensure that loss of material due to erosion will not impact the system's ability to be maintained consistent with the CLB.

Enhancement 4. LRA Section B.2.10, as modified by the applicant's response to RAI B.2.10-1, states an enhancement to the "acceptance criteria" program element. The applicant stated that the enhancement will be added to perform hardness and scratch testing for selective leaching for susceptible valves and pumps.

The staff notes that the "acceptance criteria" program element of GALL AMP XI.M20 states that the program includes managing biofouling and aggressive cooling water environments for the open-cycle cooling water systems. The applicant stated in response to RAI B.2.10-1 that this enhancement will consist of visual inspection for discoloration and evidence of degradation, which is supplemented by hardness and scratch testing if discoloration or evidence of degradation is detected. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. The staff finds that this enhancement is acceptable as discussed above in the evaluation of the response to RAI B.2.10-1.

Enhancement 5. LRA Section B.2.10, as modified by the applicant's response to RAI B.2.10-2, states an enhancement to the "acceptance criteria" program element. The applicant stated that the enhancement has been added to the Open-Cycle Cooling Water System Program to incorporate acceptance criteria into the procedures for inspection for biofouling and periodic maintenance of protective linings.

The staff notes that the “acceptance criteria” program element of GALL AMP XI.M20 states that the program includes managing biofouling and aggressive cooling water environments for the open-cycle cooling water systems. The applicant stated in response to RAI B.2.10-2 that this enhancement will provide acceptance criteria for biofouling and the maintenance of protective linings. The applicant also stated that it would add these acceptance criteria to inspection procedures and periodic maintenance instructions. The applicant further stated that these procedures would call for the removal of accumulations of biofouling agents, corrosion products, and silt and detection of defective protective coatings and corroded open-cycle cooling water system piping and components that could adversely affect performance of the intended safety function. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. The staff finds that this enhancement is acceptable as discussed above in the evaluation of the response to RAI B.2.10-2.

Enhancement 6. LRA Section B.2.10, as modified by the applicant’s response to RAI B.2.10-3, states an enhancement to the “operating experience” program element. The applicant stated that the enhancement has been added to the Open-Cycle Cooling Water System Program to incorporate nuclear services and decay heat sea water system intake conduit inspections for degraded or missing concrete lining. The applicant also stated that affected areas will be monitored to assure no loss of intended function until such time as the lining can be repaired.

The staff notes that the “operating experience” program element of GALL AMP XI.M20 states that the guidance from GL 89-13 has been implemented to manage aging effects due to biofouling, corrosion, erosion, protective coating failures, and silting in SCs serviced by the open-cycle cooling water systems. The applicant stated in response to RAI B.2.10-3 that this enhancement will provide operating experience for areas of piping with degraded or missing concrete lining. The applicant also stated that it would monitor areas of piping with degraded or missing lining to assure that there is no loss of intended function until repairs can be made. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M20. On the basis of its review, the staff finds that this enhancement is acceptable because the applicant’s actions associated with this enhancement will ensure that degraded or missing lining will not impact the system’s ability to be maintained consistent with the CLB.

Based on its audit and review of the applicant’s responses to RAIs B.2.10-1, B.2.10-2, and B.2.10-3, the staff finds that elements one through six of the applicant’s Open-Cycle Cooling Water System Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL AMP XI.M20 and, therefore, acceptable.

Operating Experience. LRA Section B.2.10 summarizes operating experience related to the Open-Cycle Cooling Water System Program. The applicant stated that a review of plant-specific operating experience identified macro-fouling in the nuclear services and decay heat sea water and decay heat closed-cycle cooling heat exchangers by loose marine shells, tube plugging activities in the nuclear services and decay heat sea water heat exchangers, degradation of protective lining in piping spools, minor system leakage, and cyclone separator and strainer fouling.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff reviewed the applicant's operating experience provided in the LRA, interviewed the applicant's technical personnel, and conducted an independent search of the applicant's condition report database during the audit to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience. It is not clear to the staff that the LRA AMP will adequately address inspection requirements for piping in which the lining has been damaged. By letter dated September 11, 2009, the staff issued RAI B.2.10-3 requesting that the applicant justify how the AMP will adequately manage aging in the unlined sections of piping or propose enhancements to the program which consider these piping sections.

In its response dated October 13, 2009, the applicant stated that the LRA has been amended and that Commitment No. 6 has been enhanced to indicate that the piping under consideration will be inspected under periodic maintenance activities for degraded and missing concrete lining. The applicant also stated that areas of piping with degraded or missing lining will be monitored to assure that there is no loss of intended function until repairs can be made.

The staff finds this response acceptable because the applicant has committed to enhancing its program sufficiently so that it is now consistent with the GALL Report as discussed above in Enhancement 6. The staff's concern described in RAI B.2.10-3 is resolved.

Based on its audit, review of the application, and review of the applicant's response to RAI B.2.10-3, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.10 provides the FSAR supplement for the Open-Cycle Cooling Water System Program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed (Commitment No. 6) to implement the new Open-Cycle Cooling Water System Program prior to entering the period of extended operation for managing aging of applicable components.

The staff reviewed the FSAR supplement and finds that the information provided is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Open-Cycle Cooling Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 6 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.2.11 describes the existing Closed-Cycle Cooling Water System Program as consistent, with exceptions, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." The applicant stated that the program relies on maintenance of system corrosion inhibitor concentrations within specified limits of the EPRI closed cooling water chemistry guidelines to minimize corrosion and that these cooling systems are closed cooling loops with controlled chemistry consistent with the GALL Report description of a closed-cycle cooling water system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M21. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M21, with the exception of the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL AMP XI.M21 recommends the use of EPRI TR-107396 "Closed Cooling Water Chemistry Guideline," under the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program element descriptions; however, during its audit, the staff found that the applicant's Closed-Cycle Cooling Water System Program will follow the EPRI 2004 Edition of the EPRI report (EPRI TR-1007820 "Closed Cooling Water Chemistry Guideline, Revision 1: Revision 1 to TR-107396, Closed Cooling Water Chemistry Guideline") in its plant procedures. By letter dated September 11, 2009, the staff issued RAI B.2.11-3 requesting that the applicant provide a comparison between the Closed-Cycle Cooling Water System Program and the 1997 and 2004 Edition EPRI guidelines and a justification for not taking an exception to the GALL Report for using the 2004 Edition EPRI guidelines.

In its response dated October 13, 2009, the applicant stated that the EPRI closed cooling water chemistry guidelines are subject to ongoing industry review and continual improvement and thus represents industry best practices to which they are evaluated by organizations such as INPO. The applicant also stated in comparing the Closed-Cycle Cooling Water System Program requirements to the EPRI standards that all control/diagnostic parameters, associated limits, and sampling frequencies were consistent with or deviations were allowed by the standard. The applicant further stated that the use of later versions of the EPRI closed cooling water chemistry guidelines for the Closed-Cycle Cooling Water System Program is consistent with GALL AMP XI.M2, "Water Chemistry Program," which allows use of later revisions of the EPRI documents and thus does not constitute an exception.

The staff finds the applicant's response acceptable because the 2004 EPRI standard represents the most up-to-date controls based on industry operating experience, and based on the staff's review of the two documents, the essential elements are unchanged and the standard appears to be no less effective. The staff's concern described in RAI B.2.11-3 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected" program element associated with exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.2.11 states an exception to the "parameters monitored or inspected" program element. This exception states that the secondary services closed-cycle cooling water system, instrument air system closed-cycle cooling, and industrial cooling system pumps are not subject to a formal testing program. The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because the industrial cooling system pumps are only within the scope of license renewal for spatial interactions and flow rate is not relevant, and because adequate flow rates and heat transfer are verified on an ongoing basis by routine operation of the system for the secondary services closed-cycle cooling water system and instrument air system closed-cycle cooling pumps. However, the staff noted that GALL AMP XI.M21 recommends monitoring pump parameters, such as the flow, discharge, and suction pressures as a part of system and component evaluation. By letter dated September 11, 2009, the staff issued RAI B.2.11-1 requesting that the applicant provide details on how the system's ability to maintain flow rates and heat transfer is ensured without subjecting the cooling water pumps to a formal testing program.

In its response dated October 13, 2009, the applicant stated that secondary services closed-cycle cooling system performance monitoring includes secondary services closed-cycle cooling pump suction and discharge pressure and flow, and the instrument air system performance monitoring includes monitoring of instrument air header pressure and dew point. The applicant also stated that it would enhance its Closed-Cycle Cooling Water System Program to flag the systems monitoring procedure to identify monitoring of these secondary services closed-cycle cooling system and instrument air system as a license renewal commitment.

The staff finds the applicant's response acceptable because the applicant's Commitment No. 29 includes verifying the pump and heat exchanger parameters in the secondary services closed-cycle cooling system by monitoring pump suction and discharge pressure and flow and in the instrument air system by monitoring the compressor and dryer performance including header pressure and dew point, and these inspection methods monitor surrogate parameters (e.g., pump parameters, header pressure, and dew point) for which changes would indicate pump parameter degradation. The staff's concern described in RAI B.2.11-1 is resolved.

Based on its review of the LRA and RAI response B.2.11-1, the staff finds the proposed exception acceptable because the applicant committed to increased parameter monitoring for the secondary services closed-cycle cooling water system and instrument air system closed-cycle cooling pumps. Additionally, flow rate is not relevant to the industrial cooling system pumps.

Exception 2. LRA Section B.2.11 states an exception to the "parameters monitored or inspected" program element. This exception states that the secondary services closed-cycle cooling water system, instrument air system, and industrial cooling system heat exchangers are not subject to a formal testing program. The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because heat transfer is not relevant to the industrial cooling system heat exchangers because they are within the scope of license renewal for spatial interaction, and acceptable thermal/hydraulic performance is verified on an ongoing basis by routine operation of the system for the secondary services closed-cycle cooling water system and instrument air system heat exchangers. However, the staff noted that the Closed-Cycle Cooling Water Program will not subject the closed-cycle cooling water heat exchangers to a formal testing program. GALL AMP XI.M21 recommends monitoring heat exchanger parameters, such as flow, inlet and outlet temperatures, and differential pressure, as a part of system and component evaluation. By letter dated September 11, 2009, the staff issued RAI B.2.11-2 requesting that the applicant provide details on how the system's ability to maintain flow rates and heat transfer is ensured without subjecting the cooling water pumps to a formal testing program.

In its response dated October 13, 2009, the applicant stated that secondary services closed-cycle cooling system and instrument air system closed-cycle cooling loop performance monitoring includes secondary services closed-cycle cooling heat exchanger flow and inlet and outlet temperatures, and the instrument air system performance monitoring includes monitoring of instrument air header pressure and dew point. The applicant also stated that it would enhance its Closed-Cycle Cooling Water System Program to flag the system's monitoring procedure to identify monitoring of these secondary services closed-cycle cooling system and instrument air system as a license renewal commitment.

The staff finds the applicant's response acceptable because the applicant's Commitment No. 29 includes verifying the heat exchanger parameters in the secondary services closed-cycle cooling system by monitoring heat exchanger flow and inlet and outlet temperatures, and instrument air closed-cycle cooling loop by monitoring the compressor and dryer performance including header pressure and dew point, and these inspection methods monitor surrogate parameters (e.g., flow, header pressure, and dew point) for which changes would indicate heat exchanger parameter degradation. The staff's concern described in RAI B.2.11-1 is resolved.

Based on its review of the LRA and RAI response B.2.11-2 the staff finds the proposed exception acceptable because the applicant committed to increased monitoring for the secondary services closed-cycle cooling water system and instrument air system closed-cycle cooling heat exchangers. Additionally, heat transfer is not relevant to the industrial cooling system heat exchangers.

Enhancement 1. LRA Section B.2.11, as modified by the applicant's responses to RAIs B.2.11-1 and B.2.11-2, state an enhancement to the "preventive actions" program element. The applicant stated that the enhancement will result in flagging chemistry controls associated with in-scope systems as license renewal commitments.

The staff notes that the "preventive actions" program element of GALL AMP XI.M21 states that the program includes monitoring and control of cooling water chemistry to minimize exposure to aggressive environments and application of corrosion inhibitor in the closed-cycle cooling water system to mitigate general, crevice, and pitting corrosion. The applicant stated in response to RAIs B.2.11-1 and B.2.11-2 that this enhancement will provide monitoring to flag procedures associated with closed-cycle cooling water chemistry controls to identify chemistry controls associated with in-scope systems. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M21. On the basis of its review, the staff finds that this enhancement is acceptable because this enhancement would ensure the applicant's staff will follow the cooling water chemistry controls and align the applicant's program with the GALL Report recommendation in the area of monitoring and control of cooling water chemistry.

Enhancement 2. LRA Section B.2.11, as modified by the applicant's responses to RAIs B.2.11-1 and B.2.11-2 and documented in Commitment No. 29, states an enhancement to the "parameters monitored or inspected" program element. The applicant stated that the Closed-Cycle Cooling Water System Program will be enhanced to revise procedures and activities credited for performance of physical inspections to reflect that inspections of components exposed to CCCW will be performed as made available on an opportunistic basis.

The staff notes that the "parameters monitored or inspected" program element of GALL AMP XI.M21 states that the program includes the following monitoring: pumps for flow, discharge pressures, and suction pressures; and heat exchangers for flow inlet and outlet temperatures and differential pressure. The staff's evaluation of this enhancement is documented above in Exception 1 and Exception 2. On the basis of its review, the staff finds that this enhancement is acceptable because the applicant's actions associated with this enhancement will ensure that the closed-cycle cooling water system is monitored by surrogate parameters to make certain that the system is able to maintain consistency with the CLB and appropriate inspections of equipment exposed to closed-cycle cooling water will occur.

Based on its audit and review of the Closed-Cycle Cooling Water System Program and the applicant's responses to RAIs B.2.11-1, B.2.11-2, and B.2.11-3, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the two exceptions associated with "the parameters monitored or inspected" program element, and their justifications, and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits. In addition, the staff reviewed enhancements and confirmed that their implementation through Commitment No. 29, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP XI.M21.

Operating Experience. LRA Section B.2.11 summarizes operating experience related to the Closed-Cycle Cooling Water System Program. The applicant stated that a review of the plant-specific operating experience identified events associated with fouling and corrosion of the nuclear services closed-cycle cooling water heat exchangers. The applicant also noted incidences of tube fouling, leakage, and de-alloying of the aluminum bronze cladding on the tubesheets, low flow, and conductivity excursion.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating

experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.11 provides the FSAR supplement for the Closed-Cycle Cooling Water System Program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed (Commitment No. 29) to enhance the Closed-Cycle Cooling Water System Program prior to entering the period of extended operation. Specifically, the applicant committed to flag those procedures credited with performance monitoring of instrument air and secondary services closed-cycle cooling water system parameters to assure pump and heat exchanger performance as a license renewal commitment.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Closed-Cycle Cooling Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justification and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that its implementation through Commitment No. 29 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Inspection of Overhead Heavy Load and Light Load Handling Systems Program

Summary of Technical Information in the Application. LRA Section B.2.12 describes the existing Inspection of Overhead Heavy Load and Light Load Handling Systems Program as consistent with GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load Handling Systems," with enhancements. The applicant stated that the inspections monitor structural members for the absence of signs of corrosion other than minor surface corrosion and crane rails for abnormal wear. The inspections are performed every refueling cycle for cranes inside the RB. Cranes outside the RB are inspected every 2 years.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M23. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M23.

The staff also reviewed the portions of the "scope of program," "parameters monitored/inspected," and "detection of aging effects" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.2.12 states an enhancement to the "scope of program" and "parameters monitored/inspected" program elements. The applicant stated that its administrative controls must be revised to include all cranes that are within the scope of license renewal.

During its audit, the staff noted that implementation of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program is through corporate and plant-specific procedures. The applicant stated that it will revise its implementing procedure to include all cranes within the scope of license renewal. The staff noted that in the "scope of program" program element of GALL AMP XI.M23, it states this program will manage degradation of those cranes that are within the scope of 10 CFR 54.4.

Based on its review, the staff finds this enhancement acceptable because the applicant will revise its implementing procedures to include all cranes within the scope of license renewal to manage age-related degradation consistent with the recommendations of the GALL Report.

Enhancement 2. LRA Section B.2.12 states an enhancement to the "parameters monitored/inspected" program element. The applicant stated that its administrative controls must be revised to require notification of the responsible engineer of unsatisfactory inspection results involving loss of material, including loss of material owing to wear of rails, for cranes within the scope of license renewal.

During its audit, the staff noted that implementation of the Inspection of Overhead Heavy Load and Light Load Handling Systems Program is through corporate and plant-specific procedures. The staff further noted that inspections of overhead heavy load and light load handling systems are through plant-specific procedures. The applicant stated that it will revise its implementing procedures to require maintenance to notify the responsible engineers of any crane inspection results that are unsatisfactory. The staff noted in the "parameters monitored/inspected" program element, it states that the program evaluates the future usage on the structural reliability of cranes.

Based on its review, the staff finds this enhancement acceptable because the applicant will revise its implementing procedures to notify the responsible engineers of any crane inspection results that are unsatisfactory so that consistent with the recommendations of the GALL Report, the future usage on the structural reliability of the cranes are evaluated.

Enhancements 3 and 4. LRA Section B.2.12 states enhancements to the "detection of aging effects" program element. The applicant stated that its administrative controls must be revised to clarify that crane rails are to be inspected for abnormal wear and members to be inspected for cracking include welds (Enhancement 3) and to specify frequency of inspections for in-scope cranes to be every refueling outage for cranes inside the RB and every 2 years for cranes outside the RB (Enhancement 4).

The staff noted that the "detection of aging effects" program element states that crane rails and structural components are to be visually inspected on a routine basis for degradation. The staff noted that the applicant will revise its plant-specific procedures so that crane rails will be inspected for abnormal wear and structural components will be inspected for cracking including the welds. The staff further noted that the applicant will specify a frequency for the periodic inspections that will be performed for the cranes within the scope of license renewal.

Based on its review, the staff finds these enhancements acceptable because the applicant will be performing periodic inspections of the crane rails and structural components for degradation consistent with the recommendations of the GALL Report.

Based on its audit, the staff finds that elements one through six of the applicant's Inspection of Overhead Heavy Load and Light Load Handling Systems Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL AMP XI.M23 and, therefore, acceptable.

Operating Experience. LRA Section B.2.12 summarizes operating experience related to the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. The applicant stated that plant-specific operating experience shows that it has performed periodic inspections of cranes and has used assessments to identify programmatic deficiencies and improvements and to track the resolutions by means of the corrective action program. The applicant stated that while there was no evidence of corrosion of structural members or wear of rails, aging management is appropriate since corrosion has been found for other carbon steel components for similar environments. The applicant noted that the crane monitoring programs are continually upgraded based upon industry experience. The applicant stated that the results of these proactive approaches to the operation and management of cranes validates the effectiveness of the procedures to implement the Inspection of Overhead Heavy Load and Light Load Handling Systems Program.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.12 provides the FSAR supplement for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed (Commitment No. 7) to enhance the Inspection of Overhead Heavy Load and Light Load Handling Systems Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program to revise its administrative controls to include in its program all cranes within the scope of license renewal, require the responsible engineer to be notified of unsatisfactory crane inspection results involving loss of material, specify the frequency of inspections for the cranes within the scope of license renewal to be every refueling outage for cranes in the RB and every 2 years for cranes outside the RB, and clarify that crane rails are to be inspected for abnormal wear and that members to be inspected for cracking include welds.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load Handling Systems Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 7 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.2.13 describes the existing Fire Protection Program as consistent, with exceptions and enhancements, with GALL AMP XI.M26, "Fire Protection." The applicant stated that the program provides aging management of the fire protection components including penetration seals; expansion joints; fire barrier walls, ceilings, and floors; fire-rated doors; diesel fire service pump fuel oil supply lines; fire barrier assemblies such as fire wraps on trays, pipes, and conduits; and the halon system used for the control complex cable spreading room.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M26. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M26.

The staff also reviewed portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "scope of program," and "acceptance criteria" program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.2.13 states an exception to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this exception, the applicant stated that the program performs functional testing of the control complex spreading room halon system once every 18 months, which differs from the GALL Report recommendation of once every 6 months.

The GALL Report recommends visual inspection and functional testing be performed on the halon fire suppression system at least once every 6 months. The staff noted that the halon system was installed in accordance with National Fire Protection Association (NFPA) Standard 12A, "Standard on Halon 1301 Fire Extinguishing Systems" (1970 Edition), which specified a 12-month testing frequency. The surveillance and testing frequency for the halon fire suppression system in the GALL Report is consistent with the current NFPA 12A Standard (2009) and NFPA "Fire Protection Systems – Inspection, Test & Maintenance Manual" (2nd edition, 1994), respectively. By letter dated September 11, 2009, the staff issued RAI B.2.13-1 requesting that the applicant provide operating history to justify the 18-month functional testing frequency.

In its response dated October 13, 2009, the applicant stated that the code of record for the halon system is NFPA 12A, 1970, which specifies a 12-month frequency for inspection and testing of halon systems. The applicant also stated that the 18-month frequency originated from License Amendment No. 13 which incorporated TSs regarding fire protection systems and administrative controls. The applicant further stated that the control complex cable spreading room environment is filtered for particulates and dehumidified by the control complex ventilation system and is an environment where corrosion of external surfaces is not expected to occur.

The staff finds the applicant's response to RAI B.2.13-1 acceptable because the applicant's testing frequency is in accordance with its CLB, the control complex spreading room halon system is not exposed to a corrosive environment, and the staff's independent review of the applicant's operating experience found no evidence of age-related events that have adversely affected the operation of the halon system. The staff's concern described in RAI B.2.13-1 is resolved.

Based on its review of the LRA and the applicant's response to RAI B.2.13-1, the staff finds the exception acceptable because of the reasons discussed above.

Exception 2. LRA Section B.2.13 states an exception to the "detection of aging effects" program element. In this exception, the applicant plans to visually inspect the structural fire barrier walls, ceilings, and floors on a frequency commensurate with the safety significance of the structure and its condition, but not to exceed 10 years.

The GALL Report recommends inspections of the fire barrier walls, ceilings, and floors be performed at least once every refueling outage. By letter dated September 11, 2009, the staff issued RAI B.2.13-2 requesting that the applicant provide additional justification for the longer time frame between inspections. In its response dated October 13, 2009, the applicant stated that activities which implement the Structures Monitoring Program already perform a visual inspection of walls, ceilings, and floors and examine for any sign of degradation such as cracking, loss of material, and change in material properties. The applicant further stated that the basis for the increased interval for structural inspections is that the plant's reinforced concrete has been acceptable during previous inspections with only minor degradation recorded in 33 years and that there have been no deficiencies of the concrete fire barrier walls, ceilings, and floors which have required corrective actions for a loss of fire barrier function. The applicant also stated that after each periodic inspection of a structure, a reassessment of the structural inspection frequency is performed based on the results of the inspection, and that the frequency of structural inspections is increased based on the condition of the structure, which would also increase the inspection frequency for the fire barriers.

The staff reviewed the applicant's response and noted that a 5-year inspection frequency is an acceptable industry structural monitoring practice, in accordance with ACI 349.3R-02, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," Table 6.1. The staff determined that the applicant did not provide sufficient information for the staff to complete its evaluation. By letter dated February 2, 2010, the staff issued RAI B.2.13-2.1 requesting that the applicant provide the following additional information for those fire barrier walls, ceilings, and floors that exceed a 5-year inspection frequency: (1) describe the process for maintaining the integrity of fire barrier walls, ceiling, and floors during normal plant operations and also during plant modifications and explain the controls that are in place to prevent inadvertent breaches to fire barrier walls, ceilings, and floors; (2) describe the current surveillance requirements for fire barrier walls, ceilings, and floors per the technical requirements manual; (3) indicate whether all parts of fire barrier walls, ceilings, and floors are inspected during each surveillance or is only a percentage performed each time which would complete the surveillance over a specific time period (i.e., 10 percent per year for 10 years); and (4) provide the frequency of inspections and the inspection criteria for those fire barrier walls, ceilings, and floors inspected under any other program.

In its response dated March 3, 2010, the applicant stated that it would inspect fire barrier walls, ceilings, and floors on a frequency of at least once every 5 years. The staff noted the applicant's choice of a 5-year inspection frequency would synchronize the fire barrier inspection with that of the structural barrier inspection in the Structures Monitoring Program. The staff reviewed the Structures Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.14. Due to the relatively slow pace of structural degradation and the plant operating experience of only minor degradation in the past 33 years, the staff finds the applicant's assessment that a 5-year visual inspection frequency is sufficient to detect fire barrier degradation acceptable. As a result, the applicant amended the Fire Protection Program in LRA Section B.2.13, the Structures Monitoring Program description in LRA Section B.2.30, the FSAR supplement in LRA Sections A.1.1.13 and A.1.1.30, and Commitment Nos. 8 and 20 to include the 5-year inspection frequency for structural fire barriers in both the Fire Protection Program and Structures Monitoring Program. The staff's concerns described in RAIs B.2.13-2 and B.2.13-2.1 are resolved.

The staff finds the exception acceptable because the applicant's operating history has shown no significant degradation of structural fire barriers and its 5-year testing frequency is in accordance with industry standards.

Enhancement 1. LRA Section B.2.13 states an enhancement to the "scope of program" and "acceptance criteria" program elements. The applicant stated that the program will be enhanced to include a procedure for periodic inspections of fire barrier walls, ceilings, and floors and also that the procedures for periodic inspections of concrete fire barrier walls, ceilings, and floors will be enhanced to add a step to notify fire protection of any deficiencies having the potential to adversely affect the fire barrier function of concrete walls, ceilings, and floors.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 2. LRA Section B.2.13 states an enhancement to the "parameters monitored or inspected" and "monitoring and trending" program elements. The applicant stated that the procedure for periodic inspection of penetration seals will be enhanced to include inspection for seal separation from walls and components, separation of layers of material, rupture and puncture of seals which are directly caused by increased hardness, and shrinkage of seal material due to weathering.

The GALL Report recommends visual inspection of approximately 10 percent of each type of penetration seal at least once every refueling outage and recommends that the inspections examine any sign of degradation such as cracking, seal separation from walls and components, separation of layers of material, rupture and puncture of seals which are directly caused by increased hardness, and shrinkage of seal material due to weathering. The GALL Report also recommends that the aging effects of weathering on fire barrier penetration seals are detectable by visual inspection and, based on operating experience, visual inspections are performed at least once every refueling outage to detect any sign of degradation of fire barrier penetration seals prior to loss of the intended function.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 3. LRA Section B.2.13 states an enhancement to the "parameters monitored or inspected" and "monitoring and trending" program elements. The applicant stated that the procedure for the annual inspection of fire doors will be enhanced to include visual inspection for loss of material (corrosion) with an acceptance criterion of absence of signs of corrosion other than minor surface corrosion.

The GALL Report recommends that fire-rated doors be visually inspected on a plant-specific interval to verify the integrity of door surfaces and for clearances. The GALL Report also recommends that based on operating experience, degraded integrity or clearances in the fire doors are detectable by visual inspection performed on a plant-specific frequency and that the visual inspections detect degradation of the fire doors prior to loss of the intended function.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 4. LRA Section B.2.13 states an enhancement to the "detection of aging effects" program element. The applicant stated that administrative controls for periodic inspections of penetration seals and fire doors will be enhanced to specify a minimum qualification requirement for qualified personnel performing visual inspections consistent with GALL recommendations.

The GALL Report recommends that visual inspections be performed by fire protection-qualified inspectors.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Based on its audit and review of the Fire Protection Program, and the applicant's responses to RAIs B.2.13-1, B.2.13-2, and B.2.13-2.1, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the two exceptions associated with the parameters monitored or inspected" and "detection of aging effects" program elements, and their justifications, and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it.

In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 8, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP XI.M26.

Operating Experience. LRA Section B.2.13 summarizes operating experience related to the Fire Protection Program. The applicant stated that the program is maintained in accordance with its engineering program requirements and managed in accordance with plant administrative controls. The applicant also stated that the operating history and assessment results for the program show that it is an effective means of ensuring safe shutdown capability in the event of a fire. The applicant further stated that the program is continually improving based on industry and plant-specific operating experience and that industry operating experience is incorporated into the program through its operating experience program and also as a result of NRC generic communications. The applicant also stated that the corrective action program is used to identify adverse conditions, track corrective actions, and make improvements.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.13 provides the FSAR supplement for the Fire Protection Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The staff also noted that the applicant committed (Commitment No. 8) to enhance the Fire Protection Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance the fire protection program administrative controls to: (1) include specific guidance for periodic inspection of fire barrier walls, ceilings, and floors including a requirement to notify fire protection of any deficiencies having the potential to adversely affect the fire barrier function; (2) include additional inspection criteria as described in the GALL Report for penetration seals; (3) include additional inspection criteria for corrosion of fire doors; (4) specify minimum qualification requirements for personnel performing visual inspections of penetrations seals and fire doors, and (5) specify inspections of fire barrier walls, ceilings, and floors for a frequency of at least once every 5 years.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Protection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 8 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.2.14 describes the existing Fire Water System Program as consistent, with enhancements, with GALL AMP XI.M27, "Fire Water System." The applicant stated that its Fire Water System Program consists of system pressure monitoring, wall thickness evaluations, and periodic flow and pressure testing in accordance with applicable NFPA standards. The applicant also stated that periodic visual inspections of the overall system condition are performed under the Fire Water System Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M27. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M27.

The staff also reviewed the portions of the "parameters monitored or inspected" and "detection of aging effects" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Enhancement 1. LRA Section B.2.14 states an enhancement to the "parameters monitored or inspected" program element. The applicant committed to perform one or both of the following activities: (1) implement a periodic flow testing requirement consistent with NFPA 25 and (2) evaluate fire water piping wall thickness through either internal inspections or a proven nondestructive method (e.g., UT).

The GALL Report recommends periodic flow testing of the fire protection piping system per NFPA 25 or wall thickness evaluations of the fire protection piping system to ensure the system maintains its intended function. This enhancement will align the applicant's fire water system with the GALL Report recommendation. The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 2. LRA Section B.2.14 states an enhancement to the "detection of aging effects" program element. The applicant committed to perform internal inspections of the fire water system piping at representative locations to ensure loss of material due to corrosion has not adversely impacted the system's ability to perform its intended function or to perform suitable nondestructive testing (e.g., UT) to verify piping integrity prior to the period of extended operation. The applicant stated that results from the initial evaluations will be used to determine the subsequent inspection intervals during the period of extended operation.

The GALL Report recommends that inspections are performed on the fire protection system piping to identify evidence of loss of material due to corrosion. This enhancement will align the applicant's fire water system with the GALL Report recommendation. The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 3. LRA Section B.2.14 states an enhancement to the "detection of aging effects" program element. The applicant committed to visually inspect its yard fire hydrants on an annual basis for signs of degradation (e.g., corrosion) in accordance with NFPA 25.

The GALL Report recommends that fire hydrants be visually inspected annually to detect any signs of degradation in accordance with NFPA 25. This enhancement will align the applicant's fire water system with the GALL Report recommendation. The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 4. LRA Section B.2.14 states an enhancement to the "detection of aging effects" program element. The applicant committed to either replace the sprinkler heads prior to reaching 50 years of service or have representative samples of the heads from one or more areas tested by a recognized laboratory in accordance with NFPA 25. The applicant stated that the results from the initial inspections will be used to determine the subsequent inspection intervals during the period of extended operation.

The GALL Report recommends replacing or testing the sprinkler heads after they have been in service for 50 years and that the testing procedure be repeated every 10 years after the initial testing per NFPA 25 (1998 and 2002 Editions). Section 5.3.1.1.1 of NFPA 25 (2002 Edition) states, in part, that "Where sprinklers have been in service for 50 years, they shall be replaced or representative samples from one or more sample areas shall be tested. Test procedures shall be repeated at 10 year intervals." The staff noted that the applicant's sprinkler heads have been in service since the start of plant operation. The staff also noted that the applicant committed to a retesting frequency based on the initial test results, not a 10-year interval as recommended by the GALL Report. By letter dated September 11, 2009, the staff issued RAI B.2.14-1 requesting that the applicant provide justification as to why the frequency of subsequent testing of the sprinklers deviates from the recommendations in the GALL Report.

In its response dated October 13, 2009, the applicant committed (Commitment No. 9) to perform sprinkler head testing at an interval of every 10 years following initial field service testing, consistent with the recommendations of the GALL Report and NFPA 25. The staff finds the applicant's response acceptable because it will make the applicant's program consistent with the testing frequency recommendations in GALL AMP XI.M27.

Based on its audit and review of the applicant's response to RAI B.2.14-1, the staff finds that elements one through six of the applicant's Fire Water System Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL AMP XI.M27 and, therefore, acceptable.

Operating Experience. LRA Section B.2.14 summarizes operating experience related to the Fire Water System Program. The applicant included a brief summary of the fire water storage tanks maintenance activities and results from the previous triennial self-assessment inspection reports. The applicant stated that preventive maintenance had been implemented for annual inspections of the water tank exterior and inspections of the internal surfaces on a 5-year frequency.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine if the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.14 provides the FSAR supplement for the Fire Water System Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2. The staff also notes that the applicant committed (Commitment No. 9) to enhance the Fire Water System Program prior to entering the period of extended operation. Specifically, the applicant committed to: (1) either implement periodic flow testing per NFPA 25 and/or perform wall thickness evaluations, (2) perform internal inspections of system piping at representative locations or suitable nondestructive testing, (3) perform visual inspection of yard fire hydrants per NFPA 25, and (4) replace the sprinkler heads prior to reaching 50 years service life or have a recognized lab field test a representative sample of heads for one or more areas and perform sprinkler head testing at an interval of every 10 years following initial field service testing.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fire Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 9 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. LRA Section B.2.16 describes the existing Fuel Oil Chemistry Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry." The applicant stated that the Fuel Oil Chemistry Program includes sampling and testing requirements and acceptance criteria in accordance with applicable ASTM standards identified in CR-3 TS surveillance requirements and chemistry program procedures for fuel oil testing. The applicant also stated that periodic sampling is performed to verify that the tanks are free of water, particulates, and biological growth. The applicant further stated that periodic tank inspections are performed to verify that the program prevents significant degradation from occurring so that the component-intended function will be maintained during the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M30. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M30.

The staff also reviewed the portions of the "scope of program," preventive actions," parameters monitored/inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the exceptions as well as the portions of the "preventive actions" and detection of aging effects" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Exception 1. LRA Section B.2.16 states an exception to the "scope of program" program element. In the GALL Report AMP, this program element recommends the use of ASTM Standards D1796, D2276, D2709, D6217, and D4057. The program element in the LRA states CR-3 uses ASTM Standard D2709 and not D1796 and uses ASTM Standard D2276 and not D6217. The applicant further provided justification for using D2709 and not D1796 by stating the acceptance criteria for D2709 and D1796 are the same and that the property being tested is similar (i.e., water and sediment content). In addition, the applicant stated that the similarities of the tested property found in D2276 and D6217 (i.e., particulates) is justification for using the former and not the latter.

The staff reviewed this exception to the GALL Report and reviewed both the ASTM standards recommended by the GALL Report and the standards used by the AMP. The ASTM standards used in this program element, D2709 and D2276, are standards that are recommended by the GALL Report for the "scope of program" program element. The staff reviewed and compared D2709 to D1796 and found that the primary differences between the two standards are that D1796 includes the addition of toluene solvent in the testing, requires the testing temperature to be maintained at 60 °C (140 °F), and requires that the minimum reporting measurement be 0.025 percent while D2709 does not include the addition of toluene solvent, requires the testing temperature to be maintained between 23 to 32 °C (70 to 90 °F), and requires that the minimum reporting measurement be 0.005 percent. The acceptance criteria for D2709 are more conservative; therefore, the staff finds the use of D2709 acceptable in lieu of D1796.

The staff reviewed the differences between D2276 and D6217 which are both tests for particulate contamination. The staff finds this program exception acceptable for the “scope of program” program element, because both the proposed standard, D2276, and the GALL Report recommended standard, D6217, are tests for particulates, so the scope of each test is equivalent.

Exception 2. LRA Section B.2.16 states an exception to the “preventive actions” program element. In the GALL Report AMP, this program element recommends periodic cleaning and draining of water collected at the bottom of tanks. The program element in the LRA states that water is not periodically drained from the bottom of the diesel-driven emergency feedwater pump fuel oil storage tank and that the tank undergoes a two-volume recirculation and is sampled quarterly through a filter-separator water coalescer designed to remove entrained fluids to determine water buildup. The applicant also stated that the two-volume recirculation provides for sampling of mixed contents. Additionally, the diesel-driven fire pump oil storage tanks (FST-2A and FST-2B) are not periodically drained of water; instead, bottom sampling of the tanks is performed quarterly to determine water buildup in the tank bottom. The applicant further stated that if water exceeding the limit is found in FST-2A and FST-2B, corrective actions will be taken to either remove the water or replace the fuel. The applicant committed to implementing enhancements to the program by adjusting the inspection frequencies so that an inspection will be performed on the tanks prior to the period of extended operation. The staff’s evaluation of this enhancement is discussed in Enhancement 1 below.

The staff reviewed this exception to the GALL Report and noted that the applicant takes exception to the GALL Report in that the diesel-driven emergency feedwater pump fuel oil storage tank and tanks FST-2A and FST-2B are not periodically drained from the bottom. In RAI B.2.16-1 dated September 11, 2009, the staff requested that the applicant justify how periodic sampling for water is equivalent to the AMP described in the GALL Report.

In its response dated October 13, 2009, the applicant stated that the quarterly testing parameters include viscosity, overall water and sediment, bottom water and sediment, particulates, specific gravity, copper strip corrosion oxidation stability, lubricity, and microbial growth. The applicant also stated that continued quality levels are assured by this periodic checking for water in tanks and sampling to confirm target values. The staff finds this method of sampling acceptable. The applicant further stated that new preventive maintenance periodic activities using UT and internal tank inspections have recently been generated for tanks FST-2A and FST-2B. In RAI B.2.16-1.1 dated November 30, 2009, the staff requested that the applicant discuss whether periodic cleaning of the tanks will be conducted.

In its response dated January 27, 2010, the applicant stated that periodic preventive maintenance activities, which include periodic draining of fuel oil and internal inspections of tanks FST-2A and FST-2B, will be performed every 2 years. The applicant stated that the results of the inspections will determine whether the tanks will be cleaned or flushed as necessary. In addition, the applicant stated that UT inspections will be performed prior to the period of extended operation and the frequency of inspection will be dependent upon the initial UT results, but not to exceed an interval of 10 years. The staff finds the performance of periodic internal and UT inspections acceptable. The staff’s concern described in RAI B.2.16-1 is resolved.

Based on the information provided in the applicant’s RAI responses, the staff finds the program exception acceptable because the applicant submitted an enhancement to commit to perform periodic tank inspections and cleaning or flushing when inspection results warrant such, prior to the period of extended operation.

Additionally, the applicant committed to performing UT inspections at intervals not to exceed 10 years. These commitments make the program consistent with the one described in GALL AMP XI.M30.

Exception 3. LRA Section B.2.16 states an exception to the "parameters monitored or inspected" program element. In the GALL Report AMP, this program element recommends the use of ASTM D2276, Method A; D2709; and D1796. The program element in the LRA states that CR-3 uses D2276-91 instead of the above-mentioned ASTM standards. The applicant also stated that the filter used in ASTM D2276-91 is a smaller pore size than the ASTM standards recommended by the GALL Report and, therefore, traps more particulate. It was stated that this smaller filter size produces more conservative results than the one recommended in the GALL Report. The applicant further stated that this program element in the LRA uses ASTM Standard D2709 and not D1796.

The staff reviewed this exception to the GALL Report and reviewed the ASTM standards recommended by the GALL Report and the ASTM standards used by the AMP. The staff reviewed the differences between D2276-91 and the ASTM standards recommended by the GALL Report and has determined that D2276-91 is more conservative. The filter pore size used in D2276-91 is 0.8 μm, while the filter pore size recommended in the GALL Report is 3.0 μm; therefore, D2276-91 is more conservative. The staff finds the use of D2276-91 acceptable because it includes a more conservative filter pore size than that recommended by the GALL Report.

The staff reviewed and compared D2709 to D1796 and found that the primary differences between the two standards are that D1796 includes the addition of toluene solvent in the testing, requires the testing temperature to be maintained at 60 °C (140 °F), and requires that the minimum reporting measurement be 0.025 percent while D2709 does not include the addition of toluene solvent, requires the testing temperature to be maintained between 23 to 32 °C (70 to 90 °F), and requires that the minimum reporting measurement be 0.005 percent. The acceptance criteria for D2709 are more conservative; therefore, the staff finds the use of D2709 in lieu of D1796 acceptable.

The staff finds this program exception acceptable and consistent with the one described in GALL AMP XI.M30 because the ASTM standards used in the AMP are more conservative than the ASTM standards recommended by the GALL Report.

Exception 4. LRA Section B.2.16 states an exception to the "detection of aging effects" program element. In the GALL Report AMP, this program element recommends the use of periodic multilevel sampling to assure that fuel oil contaminants are below unacceptable levels. The GALL Report also recommends the performance of UT of the tank bottom surface to ensure that significant degradation does not occur. The program element in the LRA states that CR-3 does not perform multilevel sampling on the diesel-driven emergency feedwater pump fuel oil storage tank and tanks FST-2A and FST-2B. The applicant performs a two-volume recirculation of the diesel-driven emergency feedwater pump fuel oil storage tank and quarterly sampling. The LRA states that performing two-volume recirculation prior to sampling provides for sampling of mixed contents.

The applicant stated that multilevel sampling is only performed on the emergency diesel fuel oil storage tanks, which can be a source for tanks FST-2A and FST-2B. In addition, the LRA states that routine sampling is not performed on the emergency diesel fuel oil day tanks; instead, its fuel volumes are cycled and refreshed each month during the emergency diesel surveillance runs. Additionally, the applicant stated that the emergency diesel fuel oil day tanks are connected to the emergency diesel fuel oil storage tanks via a cross-tie, where multilevel sampling is performed. Prior to surveillance runs, the fuel oil from the bottom of the day tanks is removed and returned to the emergency diesel fuel oil storage tanks. Furthermore, this program requires UT to be performed only if visual inspections reveal significant internal damage due to loss of material. The applicant committed to implementing enhancements to the program by adjusting the inspection frequencies for the diesel-driven emergency feedwater pump fuel oil storage tank and tanks FST-2A and FST-2B so that an inspection will be performed on the tanks prior to the period of extended operation. The staff's evaluation of this enhancement is discussed in Enhancement 2 below.

The staff reviewed this exception to the GALL Report and noted that the applicant took this exception because multilevel sampling is not performed on the diesel-driven emergency feedwater fuel oil storage tank, emergency fuel oil day tanks, and tanks FST-2A and FST-2B. In RAI B.2.16-1 dated September 11, 2009, the staff requested that the applicant justify how periodic sampling for water is equivalent to the AMP described in the GALL Report.

In its response dated October 13, 2009, the applicant stated that the quarterly testing parameters include viscosity, water and sediment, bottom water and sediment, particulates, specific gravity, copper strip corrosion oxidation stability, lubricity, and microbial growth. The applicant also stated that continued quality levels are assured by this periodic checking for water in tanks and sampling to confirm target values. The staff finds this method of sampling acceptable. The applicant further stated that new preventive maintenance periodic activities using UT and internal tank inspections have recently been generated for tanks FST-2A and FST-2B. In RAI B.2.16-1.1 dated November 30, 2009, the staff requested that the applicant provide the frequency of UT inspections for tanks FST-2A and FST-2B.

In its response dated January 27, 2010, the applicant stated that UT inspections will be performed prior to the period of extended operation, and the frequency of inspections will be dependent upon the initial UT results, but not to exceed an interval of 10 years. The staff finds the performance of UT inspections acceptable since it is consistent with the GALL Report. The staff's concern described in RAIs B.2.16-1 and B.2.16-1.1 is resolved.

Based on the information provided in the applicant's RAI responses, the staff finds this program exception acceptable and consistent with the one described in GALL AMP XI.M30. The applicant demonstrated that the sampling method recommended by the GALL Report is equivalent to the sampling method in the AMP because the method used in the AMP provides an adequate indication of fuel quality. The staff also finds the non-performance of sampling of the emergency diesel fuel oil day tanks acceptable because the fuel volume is cycled and refreshed monthly and the tanks are connected to the emergency diesel fuel oil storage tanks, via a cross-tie, where multilevel sampling is performed and the fuel oil at the bottom of the tanks is removed and returned to the emergency diesel fuel oil storage tanks. In addition, the staff finds the performance of UT inspections acceptable since it is consistent with the recommendations of the GALL Report.

Exception 5. LRA Section B.2.16 states an exception to the "acceptance criteria" program element. In the GALL Report AMP, this program element recommends the use of ASTM D2276, Method A; D2709; and D1796. The program element in the LRA states that CR-3 uses D2276-91 instead of the above-mentioned ASTM standards. The applicant justifies the use of this ASTM standard by stating that the filter included in ASTM D2276-91 is a smaller pore size than the ASTM standards recommended by the GALL Report and, therefore, traps more particulate. The applicant also stated that this smaller filter size produces more conservative results than the one recommended in the GALL Report. The applicant further stated that this program element in the LRA uses ASTM Standard D2709 and not D1796.

The staff reviewed this exception to the GALL Report and reviewed the ASTM standards recommended by the GALL Report and the ASTM standards used by the AMP. The staff reviewed the differences between D2276-91 and the ASTM standards recommended by the GALL Report and has confirmed that D2276-91 is more conservative. The filter pore size used in D2276-91 is 0.8 μm, while the filter pore size recommended in the GALL Report is 3.0 μm; therefore, D2276-91 is more conservative. The staff finds the use of D2276-91 acceptable because it is more conservative. The staff reviewed and compared D2709 to D1796 and found that the primary differences between the two standards are that D1796 includes the addition of toluene solvent in the testing, requires the testing temperature to be maintained at 60 °C (140 °F), and requires that the minimum reporting measurement be 0.025 percent while D2709 does not include the addition of toluene solvent, requires the testing temperature to be maintained between 23 to 32 °C (70 to 90 °F), and requires that the minimum reporting measurement be 0.005 percent. The acceptance criteria for D2709 are more conservative; therefore, the staff finds the use of D2709 acceptable in lieu of D1796.

The staff finds this program exception acceptable and consistent with the one described in GALL AMP XI.M30 because the ASTM standards used in the AMP are more conservative than the ASTM standards recommended by the GALL Report.

Enhancement 1. LRA Section B.2.16 states an enhancement to the "preventive actions" program element. This enhancement expands on the existing program element by adjusting the inspection frequency for the diesel-driven emergency feedwater pump fuel oil storage tank to ensure an inspection is performed prior to the period of extended operation. Additionally, the applicant plans to conduct an inspection of the internal surfaces of tanks FST-2A and FST-2B and use the results to develop a work activity for periodic inspections of the internal surfaces of these tanks. The applicant also stated that UT or other NDE will be performed if visual inspections prove inadequate or indeterminate.

The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The staff noted that the applicant does not include information on the frequency of inspection of the internal surfaces of these tanks. In RAI B.2.16-1.1 dated November 30, 2009, the staff requested that the applicant provide the frequency of UT and internal inspections of tanks FST-2A and FST-2B. In addition, the staff requested that the applicant discuss whether periodic cleaning of the tanks will be conducted.

In its response dated January 27, 2010, the applicant stated that periodic preventive maintenance activities, which include periodic draining of fuel oil and internal inspections of tanks FST-2A and FST-2B, will be performed every 2 years. The applicant also stated that UT inspections will be performed prior to the period of extended operation and the frequency of inspections will be dependent upon the initial UT results, but not to exceed intervals of 10 years. The staff finds performance of periodic internal and UT inspections acceptable.

The staff finds the applicant's response acceptable because the performance of periodic internal and UT inspections of tanks FST-2A and FST-2B will make the program consistent with the recommendations in GALL AMP XI.M30.

Enhancement 2. LRA Section B.2.16 states an enhancement to the "detection of aging effects" program element. This enhancement expands on the existing program element by adjusting the inspection frequency for the diesel-driven emergency feedwater pump fuel oil storage tank to ensure an inspection is performed prior to the period of extended operation. Additionally, the applicant plans to conduct an inspection of the internal surfaces of tanks FST-2A and FST-2B and use the results to develop a work activity for periodic inspections of the internal surfaces of these tanks. The applicant also stated that UT or other NDE will be performed if visual inspections prove inadequate or indeterminate.

The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The staff noted that the applicant does not include information on the frequency of inspection of the internal surfaces of these tanks. In RAI B.2.16-1.1 dated November 30, 2009, the staff requested that the applicant provide the frequency of UT and internal inspections of tanks FST-2A and FST-2B. In addition, the staff requested that the applicant discuss whether periodic cleaning of the tanks will be conducted.

In its response dated January 27, 2010, the applicant stated that periodic preventive maintenance activities, which include periodic draining of fuel oil and internal inspections of FST-2A and FST-2B, will be performed every 2 years. The applicant also stated that UT inspections will be performed prior to the period of extended operation, and the frequency of inspections will be dependent upon the initial UT results, but not to exceed intervals of 10 years. The staff finds the performance of periodic internal and UT inspections acceptable.

The staff finds the applicant's response acceptable because the performance of periodic internal and UT inspections of FST-2A and FST-2B will make the program consistent with the recommendations in GALL AMP XI.M30.

Based on its audit and review of the Fuel Oil Chemistry Program, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the five exceptions associated with the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, and their justifications, and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits. In addition, the staff reviewed the two enhancements and confirmed that their implementation through Commitment No. 11, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP XI.M30.

<u>Operating Experience</u>. LRA Section B.2.16 summarizes operating experience related to the Fuel Oil Chemistry Program. The staff reviewed this information and interviewed the applicant's technical personnel during the onsite audit to confirm that the applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. During the audit, the staff independently verified that the applicant had adequately incorporated and evaluated operating experience related to this program.

The applicant provided the following for operating experience:

> The Fuel Oil Chemistry Program is implemented and maintained in accordance with the general requirements for chemistry programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements. Qualified personnel are assigned as program managers and are given authority and responsibility to implement the Program. In addition, adequate resources are committed to Program activities. Specific examples of OE [operating experience] include:
>
> Diesel fuel oil particulates are increasing. The problem was related to the mixing of diesel fuels and the lack of a fuel stabilizer. In November 2007, while in a refueling outage, the Emergency Diesel Generator Fuel Oil Storage Tanks were off-loaded and the fuel was filtered through a very fine clay media filtration process. The particulates for both tanks were reduced significantly to about 1mg/L [milligrams per liter] or less. While this cleaned the fuel, it was noted this would not prevent the recurrence of particulate formation without the use of a fuel stabilizer. Southwest Research Institute (SWRI) was contracted to help resolve the diesel fuel particulate issue; this same organization provided testing and recommendations in 2007 to help resolve the fuel particulate issues that were occurring at that time. SWRI previously recommended CR-3 no longer accept high sulfur diesel fuel for use onsite, clay filter the fuel during the refueling outage, and use a fuel stabilizer. The investigation is ongoing, with CR-3 currently using a fuel stabilizer.
>
> The Diesel Driven Fire Pump Fuel Oil Storage Tanks [FST-2A and FST-2B] have an increasing trend on particulates. The particulate levels are at 6.93 mg/L, just below the administrative limit of 7.0. The action was to replace the fuel oil in the tanks.

In order to obtain the information necessary to verify whether the applicant's operating experience supports the sufficiency of the LRA AMP, the staff issued RAI B.2.16-1 dated September 11, 2009, and requested that the applicant discuss the cause(s) of the 2009 tank particulate issue and whether it is related to the tank sampling process currently employed for tanks FST-2A and FST-2B. In its response dated October 13, 2009, the applicant stated:

> Several actions have been beneficial in reducing particulates in the two tanks. Recent actions have included flushing, cleaning, and refilling the tanks. In addition, the plant has recently initiated use of a diesel fuel stabilizer containing corrosion inhibitors. Chemistry analyses records clearly indicate that the level of particulates in FST-2A and FST-2B have dropped dramatically over the last two years. FST-2A particulates were measured as high as 24 in early 2008 and recently were measured at 3.
>
> FST-2B particulates were measured as high as 18 in late 2007 and recently were measured at 3. Based on purchasing, sampling, and testing requirements, and the use of fuel oil additives, the program ensures that significant degradation is not occurring and that the component intended function will be maintained during the extended period of operation.

The staff finds the applicant's response acceptable because the applicant stated that actions have been taken (i.e., flushing, cleaning, refilling, and use of a diesel stabilizer) that have reduced the level of particulates in the tanks and that adequate actions will be taken to ensure that significant degradation will not occur during the period of extended operation.

In addition, the staff issued RAI B.2.16-2 dated September 11, 2009, requesting that the applicant provide a summary of the actions that were taken to determine the impact of IN 2009-02, "Biodiesel in Fuel Oil Could Adversely Impact Diesel Engine Performance," and the use of biodiesel fuel oil at CR-3. In its response dated October 13, 2009, the applicant stated:

> Biodiesel is not being used at CR-3. Progress Energy utilizes a Common Diesel Fuel Oil (Grade 2-D) Testing Specification in controlling the purchase of new diesel fuel for its nuclear fleet. This specification states that due to the increasing potential of Number 2 diesel fuel oil containing a blend of biodiesel, prudent precautions shall be taken to ensure that no biodiesel fuel is accepted, even when mixed with any Grade 2-D diesel fuel. IN 2009-02 was considered as an input in the recent revision of this fuel oil specification. The specification also states that testing shall be conducted prior to fuel delivery to verify the absence of biodiesel in Number 2 diesel fuel oil using test method ASTM D7371-07. The specification identifies that new diesel fuel oil will be pre-offload tested so that the maximum amount of biodiesel is 1.0% by volume. This test is required to be satisfactorily completed prior to offloading the diesel fuel into the CR-3 fuel oil storage tanks.

The staff finds the applicant's response acceptable because the applicant stated that biodiesels are not used at CR-3 and that appropriate measures are taken to ensure biodiesel fuel is not accepted. The applicant appropriately considered the information contained IN 2009-02 regarding operating experience. The staff's concern described in RAI B.2.16-2 is resolved.

The staff confirmed that the applicant addressed operating experience identified after issuance of the GALL Report. Based on its review, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and implementation of this program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

<u>FSAR Supplement</u>. LRA Section A.1.1.16 provides the FSAR supplement for the Fuel Oil Chemistry Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The applicant also stated that the effectiveness of the program is verified using visual inspections of tanks to ensure that significant degradation does not occur and committed to maintain the component intended-function of the program during the period of extended operation. Additionally, the applicant committed (Commitment No.11) to enhance the Fuel Oil Chemistry Program prior to entering the period of extended operation. Specifically, the applicant committed to:

(1) adjust the inspection frequency for the diesel-driven emergency feedwater pump fuel oil storage tank to ensure an inspection is performed prior to the period of extended operation

(2) inspect the internal surfaces of the diesel-driven fire pump fuel oil storage tanks every 2 years

(3) perform UT inspections of diesel-driven fire pump fuel oil storage tanks (FST-2A and FST-2B) prior to the period of extended operation and at intervals not to exceed 10 years

The staff evaluated the commitments and finds them acceptable since they give reasonable assurance that fuel oil quality will be adequately managed in the period of extended operation. The staff determined that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fuel Oil Chemistry Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.2.17 describes the existing Reactor Vessel Surveillance Program, as consistent with enhancements and an exception with GALL AMP XI.M31, "Reactor Vessel Surveillance." CR-3 participates in the Master Integrated Reactor Vessel Surveillance Program (MIRVP) to monitor the effects of neutron embrittlement on the RV beltline materials. The program satisfies the requirements of 10 CFR Part 50, Appendix H, "Reactor Vessel Materials Surveillance Program Requirements." The Reactor Vessel Surveillance Program evaluates the effect of neutron embrittlement by projecting upper-shelf energy (USE) and pressurized thermal shock (PTS) reference temperatures for all RV materials with projected neutron exposure greater than 10^{17} n/cm^2 (E greater than 1.0 MeV) after 60 years of operation and with the development of pressure-temperature limit curves. Embrittlement information is obtained in accordance with NRC Regulatory Guide 1.99, Revision 2, chemistry tables and with surveillance capsules, which have provided credible data for the current operating period and for the period of extended operation. The surveillance program design, capsule withdrawal schedule, and evaluation of test results are in accordance with ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels." Select tested specimens are stored for future use, if needed. The Reactor Vessel Surveillance Program controls the remaining capsules so that withdrawal of the remaining capsules is managed through the MIRVP and has been approved by the NRC. The Reactor Vessel Surveillance Program manages the steps taken if RV exposure conditions are altered, such as, the review and updating of 60-year neutron fluence projections to support the preparation of new pressure-temperature limit curves and PTS reference temperature calculations.

Staff Evaluation. The staff reviewed the applicant's claim of consistency with the GALL Report. In LRA Section B.2.17, the applicant described its AMP to manage aging in reactor vessel beltline materials. The staff reviewed the LRA for consistency with GALL AMP XI.M31.

Exception. LRA Section B.2.17 states an exception to the "detection of aging effects" program element. In this exception, the applicant stated that GALL AMP XI.M31 element 4 states that, "all pulled and tested capsules, unless discarded before August 31, 2000, are placed in storage." Some MIRVP tested specimens were not retained for future reconstitution use. However, sets of specimens from CR-3 beltline weld heats are permanently archived at the Point Beach Nuclear Plant.

Appendix H to 10 CFR Part 50 includes requirements to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors which result from exposure of these materials to neutron irradiation and the thermal environment. GALL AMP XI.M31 specifies additional criteria for 60 years of operation.

Appendix H to 10 CFR Part 50 endorses ASTM Standard E 185. Appendix H states that "the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of ASTM E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased. Later editions of ASTM Standard E 185 may be used, but including only those editions through 1982." ASTM E 185-82 covers procedures for monitoring the radiation-induced changes in the mechanical properties of ferritic materials in the beltline of light-water cooled nuclear power reactor vessels. These practices include guidelines for designing a minimum surveillance program, selecting materials, and evaluating test results.

GALL AMP XI.M31 "detection of aging effects" program element states that, "all pulled and tested capsules, unless discarded before August 31, 2000, are placed in storage." CR-3 participates in the Pressurized Water Reactor Owners Group (PWROG) MIRVP, to monitor the reactor vessel beltline materials that are projected to exceed a cumulative neutron fluence of 1×10^{17} n/cm^2 (E > 1.0 MeV) during 60 years of operation. Some MIRVP tested specimens were not retained for future reconstitution use. However, sets of specimens from CR-3 beltline weld heats are permanently archived at the Point Beach Nuclear Plant.

The MIRVP was initiated in 1977 with the seven operating Babcock & Wilcox (B&W) 177-fuel assembly plants. In 1988, six Westinghouse-designed plants having B&W-fabricated reactor vessels joined the MIRVP. The integrated program is feasible because of the similarity of the design and the operating characteristics of the affected plants, as required by 10 CFR Part 50, Appendix H, paragraph III.C. The purpose of the MIRVP is to augment the existing RV surveillance programs for the participating units, and to provide a basis for sharing information between plants. Staff reviews have concluded that the MIRVP provides sufficient material data to meet the requirement for monitoring reactor vessel embrittlement.

The MIRVP consists of two parts. The first is a plant-specific program. The CR-3 Reactor Vessel Surveillance Program has data from five capsules containing the CR-3 limiting weld materials. The second part of the MIRVP consists of special research capsules designed to provide fracture toughness data on Linde 80 weld metals, which are predicted to exhibit high sensitivity to irradiation damage. The MIRVP capsule withdrawal schedule for limiting Linde 80 weld metal heats addresses neutron fluence exposures corresponding to 60 years of operation.

By letter dated June 11, 1991, the staff approved the basis for the MIRVP concept (BAW-1543, "Master Integrated Reactor Vessel Surveillance Program," Revision 3), concluding that the program met the criteria provided by Appendix H to 10 CFR Part 50. Revision 4 to BAW-1543, issued in February 1993, updated some of the MIRVP units' withdrawal schedules. Additional supplements to BAW-1543, Revision 4 were provided to update information, particularly regarding neutron fluence values and withdrawal schedules. BAW-1543, Revision 4, Supplement 1 provided revised neutron fluence values for some units and revised some withdrawal schedules to comply with the 1973 Edition of ASTM Standard E 185 (ASTM E 185-73). BAW-1543, Revision 4, Supplement 2, issued in June 1996, reflected revised neutron fluence values and withdrawal schedules. BAW-1543, Revision 4, Supplement 3, issued in February 1999, deleted Rancho Seco, R.E. Ginna, and Zion, Units 1 and 2 from the MIRVP. BAW-1543, Revision 4, Supplement 4, issued in April 2001, added a disposal plan for archived specimens, updated the status for various capsules, and incorporated current neutron fluence levels. The staff approved the revised and updated information by letter dated July 31, 2001 (ADAMS Accession No. ML0121303741), concluding that the proposed revisions satisfied the ASTM E 185-82 standards for plants participating in the MIRVP, with the exception of Turkey Point, Units 3 and 4. BAW-1543, Supplement 4, Revision 5, issued in December 2003, revised withdrawal schedules. By letter dated May 16, 2005 (ADAMS Accession No. ML051400361), the staff reviewed BAW-1543, Revision 5 and concluded that the proposed withdrawal schedules complied with Appendix H to 10 CFR Part 50. BAW-1543, Supplement 4, Revision 6 was submitted in December 2005, with updated neutron fluence values and surveillance capsule insertion and withdrawal schedules. By letter dated June 28, 2007 (ADAMS Accession No. ML071770640), the staff concluded that the revisions were acceptable and the proposed withdrawal schedules satisfy the ASTM Standard E 185-82.

The CR-3 Surveillance Program has data from five capsules containing the CR-3 limiting weld materials, satisfying the fifth capsule requirement of ASTM Standard E 185-82. The projected cumulative neutron fluence at 54 EFPY for the limiting weld material is 1.56×10^{19} n/cm^2 (E greater than 1.0 MeV). In the MIRVP, CR-3 materials have received neutron fluences very close to the 54 effective full power years (EFPY) CR-3 reactor vessel projected peak neutron fluence. This meets the ASTM E 185-82 criterion which states that capsules may be removed when the capsule neutron fluence is between one and two times the limiting neutron fluence calculated for the vessel at end of license. In addition, other surveillance capsules are available within the MIRVP, which bound the 54 EFPY neutron fluence of the limiting CR-3 weld materials, and support the adequacy of this program for CR-3 license renewal. The staff reviewed the exception to GALL AMP XI.M31. Based upon the applicant's participation in the MIRVP and supporting information, the staff concludes that the exception is acceptable, and the CR-3 AMP remains adequate to manage the aging effects for which it is credited.

Enhancement 1. LRA Section B.2.17 states an exception to the "scope of program," "acceptance criteria," "corrective actions," and "confirmation process" program elements. In this enhancement, the applicant stated that the program will be enhanced to ensure that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year license period.

This enhancement ensures that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year extended license period, which effectively puts applicable limitations on operating conditions to which the surveillance capsules are exposed. The “scope of program” program element is satisfied when RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” is appropriately used in the applicant’s evaluation of USE, PTS, and pressure/temperature (P-T) limits. Changes in plant parameters, such as the neutron fluence to which RV materials are exposed, are evaluated for impact on the applicability of RG 1.99, Revision 2. The 13 reactors of the MIRVP are of the same basic design concept: pressurized water reactors operating at about 550 °F and 2250 psi nominal inlet temperature and pressure, and with low enrichment fuel (approximately 2 percent to 4 percent enrichment). This results in consistency of neutron exposure conditions.

The “acceptance criteria” program element ensures that data used for reactor vessel embrittlement projections comply with 10 CFR Part 50, Appendix G requirements through the period of extended operation. The applicant commits in the enhancement that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year extended license period. The Reactor Vessel Surveillance Program provides that if future plant operations exceed these limitations or bounds, such as operating at a lower cold leg temperature or higher fluence, the impact of plant operation changes on the extent of reactor vessel embrittlement is evaluated and the NRC is notified. Therefore, the “acceptance criteria” program element is satisfied.

The “corrective actions” program element provides guidelines for applicants without surveillance capsules. As a member of the MIRVP, the applicant will have surveillance data available with neutron exposure conditions of the reactor vessel remaining bounded by those used to project the effects of embrittlement to the end of the 60-year extended license period. This satisfies the “corrective actions” program element.

The “confirmation process” program element relates to the potential need to include the reactor vessel nozzle materials in the AMP. Based on the staff’s evaluations and conclusions in the SER Sections 4.2.2 and 4.2.3, it is clear that the reactor vessel nozzle materials are not controlling. Therefore, the “confirmation process” program element is satisfied.

Enhancement 2. LRA Section B.2.17 states an exception to the “detection of aging effects,” program element. In this enhancement, the applicant stated that the program will establish formalized controls for the storage of archived specimens to ensure availability for future use by maintaining the identity, traceability, and recovery of the archived specimens throughout the period of storage.

This enhancement establishes formalized controls for the storage of archived specimens to ensure availability for future use by maintaining the identity, traceability, and recovery of the archived specimens throughout the period of storage. The “detection of aging effects” program element of GALL AMP XI.M31 recommends, “[a]ll pulled and tested capsules, unless discarded before August 31, 2000, are placed in storage. (Note: These specimens are saved for future reconstitution use, in case the surveillance program is reestablished.)” The emphasis of GALL AMP XI.M31 is tested specimens. The staff, therefore, concludes that the enhancement is acceptable because it addresses the scope of the “detection of aging effects” program element of GALL AMP XI.M31 to include requirements for storing archived specimens. Through specimen retention, the overall task of irradiating archival or reconstituted specimens becomes easier to manage.

On the basis of its review of the applicant’s Reactor Vessel Surveillance Program, the staff determines that the program elements for which the applicant claimed consistency with the

GALL Report are consistent. The staff also reviewed the "detection of aging effects" program element, and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits. In addition, the staff reviewed the two enhancements and confirmed that their implementation through Commitment No. 12, prior to the period of extended operation, would make the existing AMP consistent with the GALL AMP XI.M31.

Operating Experience. The staff reviewed the operating experience provided in LRA Section B.2.17 to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. The applicant provided the following information related to operating experience:

- The MIRVP was designed when the surveillance capsule holder tubes in a number of B&W reactors were damaged and could not be repaired without a complex and expensive repair program and considerable radiation exposure to personnel. For these plants, including CR-3, the original Reactor Vessel Surveillance Program could not provide sufficient material data and dosimetry to monitor embrittlement; therefore, the integrated program was developed. The purpose of the MIRVP is to augment the existing Reactor Vessel Surveillance Programs for the participating units and to provide a basis for sharing information between plants. The integrated program is feasible because of the similarity of the design and operating characteristics of the affected plants, as required by 10 CFR Part 50, Appendix H, paragraph III.C. The integrated program provides sufficient material data to meet the ASTM E 185-82 capsule program requirement for monitoring embrittlement. The NRC staff evaluated the basis for the integrated program concept, determined the MIRVP to be acceptable, and approved Topical Report BAW-1543, Revision 3, by letter dated June 11, 1991. This letter concluded that the program met the applicable criteria from 10 CFR Part 50, Appendix H.

- BAW-1543, Revision 4, Supplement 4 included a commitment regarding the removal of capsules OC1-D and OC3-F. Because these capsules could not be removed from the CR-3 RV, BAW-1543, Revision 4, Supplement 5 was issued with a revised withdrawal schedule. NRC staff reviewed and approved the revised withdrawal schedule, concluding that the requirements of 10 CFR Part 50, Appendix H and ASTM E 185-82 were not impacted because there were additional capsules within the MIRVP that contained the same limiting material.

The applicant stated that the operating experience of the Reactor Vessel Surveillance Program, with the identified enhancements, will provide reasonable assurance that neutron embrittlement aging effects will be managed so that applicable systems and components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Based on its review, the staff finds that the evaluation of operating experience for this AMP demonstrated that the proposed Reactor Vessel Surveillance Program is capable of managing the reduction of fracture toughness of the reactor vessel beltline materials due to neutron embrittlement. The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

FSAR Supplement. LRA Section A.1.1.17 provides the FSAR supplement for the Reactor Vessel Surveillance Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff also notes that the applicant committed (Commitment No. 12) to enhance the Reactor Vessel Surveillance Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program to ensure that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year extended license period and to establish formalized controls for the storage of archived specimens to ensure availability for future use by maintaining the identity, traceability, and recovery of the archived specimens throughout the storage period.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Vessel Surveillance Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Selective Leaching of Materials Program

Summary of Technical Information in the Application. LRA Section B.2.19 describes the new Selective Leaching of Materials Program as consistent, with an exception, with GALL AMP XI.M33, "Selective Leaching of Materials." The applicant stated that its program ensures the integrity of components such as piping, pump casings, valve bodies, and heat exchanger components made of gray cast iron, uninhibited copper alloys with zinc content greater than 15 percent, or aluminum content greater than 8 percent exposed to raw water, treated water, closed-cycle cooling water, open-cycle cooling water, fire water, steam, fuel oil, uncontrolled indoor air, or soil environment that may lead to selective leaching. The applicant also stated that it will use a new inspection procedure defining a one-time examination methodology which will be implemented by the work management process using a qualitative determination for selection of susceptible components.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M33. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M33, with the exception of the "scope of program" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL AMP XI.M33 includes brackish water within the scope of environments to be considered for the Selective Leaching of Materials Program, however, during its audit, the staff found that all the environments recommended in the GALL Report were included in the LRA AMP except for brackish water. By letter dated September 11, 2009, the staff issued RAI B.2.19-2 requesting that the applicant clarify if the program encompassed brackish water.

In its response dated October 13, 2009, the applicant stated that the program addresses and envelopes a brackish water environment. The applicant also stated that LRA Table 3.0-1, "Service Environments," states that the Gulf of Mexico (sea water) provides one source of raw water used by the plant.

The staff finds the applicant's response to RAI B.2.19-2 acceptable because its program includes the environments recommended by the GALL Report that exist at the plant. The staff's concern described in RAI B.2.19-2 is resolved.

The staff noted during its review that additional information was required for the "scope of program" program element. Due to the uncertainty in determining the most susceptible locations and the potential for aging to occur in other locations, the staff noted that large sample sizes may be required in order to adequately confirm an aging effect is not occurring. The applicant's Selective Leaching Program did not include specific information regarding how the selected set of components to be sampled or the sample size will be determined. Therefore, by letter dated November 30, 2010, the staff issued RAI B.2.19-3 requesting that the applicant provide specific information regarding how the population of components to be sample will be determined and the size of the sample of components that will be inspected. Pending receipt and review of the applicant's response to RAI B.2.19-3, this issue has been identified as **OI-3.0.3.2.10-1**.

The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements associated with an exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.2.19 states an exception to the "scope of program," "parameters monitored/inspected," and "detection of aging effects" program elements. The applicant stated that a qualitative determination of the existence of selective leaching may be used in lieu of the hardness testing recommended by the GALL Report. The applicant also stated that brinell hardness testing may not always be feasible due to form and configuration of the components and other mechanical means such as scraping or chipping provide an equally valid method of identification of selective leaching.

The staff notes that in its response to RAI B.2.10-1 associated with the Open-Cycle Cooling Water System Program, the applicant stated that visual inspections would be performed to detect discoloration and evidence of degradation of susceptible valves and pumps exposed to raw water, and where such indications were evident, hardness or scratch testing would be performed. The staff also notes that while this response was associated with a subset of the components inspected by the Selective Leaching of Materials Program, it provides an insight to the applicant's inspection methodology. The staff finds the applicant's exception acceptable because brinell hardness testing is not always feasible, visual methods will detect symptoms of selective leaching (e.g., discoloration), other mechanical methods such as scraping and chipping will detect selective leaching, and the applicant cited two plant-specific operating experience examples of detection of selective leaching that did not originate from hardness testing.

Based on its audit and review of the Selective Leaching of Materials Program and the applicant's response to RAI B.2.19-2, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the exception to the "scope of program," "parameters monitored/inspected," and "detection of aging effects" program elements, and its justification, and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.19 summarizes operating experience related to the Selective Leaching of Materials Program. The applicant stated that the Selective Leaching of Materials Program is a new program for which operating experience is not available to verify the effectiveness of this program. The applicant also stated that plant-specific instances of selective leaching of materials have been revealed by past inspections; two examples being selective leaching of the cast iron components of the discharge flange for a sea water pump and a failed bronze hinge pin from the operating arm of a raw water valve found in a decay heat closed-cycle heat exchanger. The applicant further stated that the actions specified by the corrective action program will ensure that appropriate measures are taken to preclude and monitor for recurrence in systems selective leaching is detected as well as other systems with similar material and environment combinations.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

In LRA Section B.2.19, the applicant did not sufficiently describe the search and review of industry operating experience other than at other plants within its company for the staff to evaluate the acceptability of the AMP. By letter dated September 11, 2009, the staff issued RAI B.2.19-1 requesting that the applicant provide additional description of the industry operating experience searched and reviewed and how it will be implemented or used for the basis and actions of the Selective Leaching of Materials Program and specifics as to databases, sources, and documents searched.

In its response dated October 13, 2009, the applicant provided descriptions of the methods, sources, and reports searched and reviewed for operating experience in planning the LRA and this AMP and identified its operating experience program and procedural commitments for ongoing review, screening, and evaluation of industry, as well as plant-specific, operating experience for applicability.

The staff finds the applicant's response to RAI B.2.19-1 acceptable because it had used industry operating experience from a wide variety of sources during development of the AMP (e.g., EPRI, INPO Significant Event Notifications (SENs), INPO SERs, NRC documents, vendor bulletins) and the plant continues to screen industry operating experience by its operating experience program. The staff's concern described in RAI B.2.19-1 is resolved.

Based on its audit, review of the application, and review of the applicant's response to RAI B.2.19-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.19 provides the FSAR supplement for the Selective Leaching of Materials Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, and 3.3-2. The staff also notes that the applicant committed (Commitment No. 14) to implement the new Selective Leaching of Materials Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Selective Leaching of Materials Program, the staff determines, pending resolution of OI–3.0.3.2.10–1, that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 External Surfaces Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.22 describes the existing External Surfaces Monitoring Program as consistent, with enhancements, with GALL AMP XI.M36, "External Surfaces Monitoring." The applicant stated that this program will conduct periodic visual inspections of external surfaces of in-scope plant components (e.g., piping, piping components, ducting) when performing system inspections and walkdowns for loss of material and wastage. The applicant also stated that the program will include measures to provide assurance that aging effects are managed on surfaces that are inaccessible during both plant operations and refueling outages. The applicant further stated that loss of material due to boric acid corrosion is managed by the Boric Acid Corrosion Program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M36. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M36, with the exception of the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The program description and “scope of program” program element of GALL AMP XI.M36 recommends monitoring and inspection of the external surfaces of steel components (e.g., piping, piping components, and ducting) for loss of material, leakage, discoloration, and coating degradation through visual inspections during periodic walkdowns. The “parameters monitored or inspected” program element describes the steel components to be inspected and provides recommended inspection parameters (e.g., leakage, wastage, oxide-coated surfaces, stains on insulation). The “detection of aging effects” program element of GALL AMP XI.M36 provides guidance on how often to assess the effects of corrosion on steel surfaces. In the audited program basis document, the applicant included, in addition to carbon steel, a diverse number of materials ranging from other metals (i.e., stainless steel, aluminum, and copper) to coatings and non-metallics (e.g., elastomers, PVCs, thermoplastics, fiberglass, fiber-reinforced plastics) to be within the scope of this program. By letter dated September 11, 2009, the staff issued RAI B.2.22-1 requesting that the applicant justify why the added range of materials is not an exception to the GALL Report; provide information related to inspection attributes, monitoring of degradation, and methods and procedures that will be used to identify aging in the materials not within the scope of GALL AMP XI.M36; and explain how reduction of heat transfer could be monitored by this AMP.

In its response dated October 13, 2009, the applicant stated that the addition of materials other than steel to the program constitutes an exception to GALL AMP XI.M36 and revised the LRA to include the exceptions. Also, the program performs visual inspections to identify signs of aging in non-steel materials and summarized the inspection parameters to be used for those materials, and the component monitored for reduction of heat transfer by visual inspection is a chiller with radiator tubes that are accessible for visual inspection. The applicant also stated the program uses the following inspection attributes to detect aging of the additional materials: paints and protective coatings through observations of cracking, flaking, blistering, and missing of surface coatings; polymers and elastomers through observations of cracking, peeling, blistering, chalking, crazing, delamination, flaking, discoloration, physical distortion, gross softening, indications of wear, and loss of material; copper, aluminum, and stainless steel through loss of material; and evidence of corrosion mechanisms such as rust, oxidation, sensitization, and discoloration. The applicant further stated that physical manipulation and testing of elastomers to detect hardening and loss of strength is performed under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. However, the applicant did not explain how hardening and loss of strength for elastomers would be managed. The staff noted that in the applicant’s response to RAI B.2.23-1 dated December 30, 2009, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes visual and tactile testing (e.g., scratching, bending, folding, stretching) of non-metal components including elastomers, fiberglass, and thermoplastics that will be used to identify hardening and loss of strength in those components.

The applicant’s response to RAI B.2.22-1 included the revision of several enhancements contained in the original LRA, addition of three exceptions, revision of the FSAR supplement, and revision of Commitment No. 17. The staff finds the applicant’s response acceptable because the applicant revised the LRA to include exceptions to GALL AMP XI.M36. Additionally, the visual inspection parameters included in the program are appropriate for the additional materials, and visual inspection is an appropriate method for evaluating the aging mechanisms included for the non-steel materials included within the scope of the program. The staff’s concern described in RAI B.2.22-1 is resolved.

The staff also reviewed the portions of the “scope of program,” “parameters monitored or inspected,” and “detection of aging effects” program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the exceptions and enhancements follows.

Exception 1. LRA Section B.2.22, as amended by the applicant's response to RAI B.2.22-1, states an exception to the "scope of program" program element. The exception states that the program will manage the aging effects for components composed of steel and other materials, including stainless steel, aluminum, copper, coatings, elastomers, PVCs, thermoplastics, fiberglass, and fiber-reinforced plastics. The staff reviewed this exception and the response to RAI B.2.22-1. The staff finds the exception acceptable because the applicant's program includes inspection parameters (as discussed in the staff evaluation section above) which are appropriate to identify degradation due to aging for the additional materials included within the scope of the program.

Exception 2. LRA Section B.2.22, as amended by the applicant's response to RAI B.2.22-1, states an exception to the "parameters monitored or inspected" program element. The exception states that the program is credited for using inspection parameters beyond those specified in the GALL Report. These inspection parameters are implemented during visual examinations of the specified materials for the aging effects the program manages, including inspection of finned tube heat transfer surfaces for evidence of fouling. The staff reviewed this exception and the response to RAI B.2.22-1.

The staff finds the exception acceptable because the applicant stated that the elastomers and various metallics inspected are in an indoor air environment; and according to NUREG-1833, "Technical Bases for Revision to the License Renewal Guidance Documents," these commodities in such an environment exhibit no aging effects. Also, elastomers will be physically manipulated by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, or subjected to other testing that can detect loss of strength, changes in hardness, and changes in other volumetric properties (discussed in the applicant's responses to RAIs B.2.23-1 and 3.4.2.3-1, dated December 30, 2009), the combination of inspection parameters discussed in the response to RAI B.2.22-1 with those in GALL AMP XI.M36 will support aging identification of the additional materials and coatings, and the inspection for reduction of heat transfer is restricted to the finned tube surfaces of the externally visible radiator tubes of the Appendix R chiller which can be visually inspected for fouling.

Exception 3. LRA Section B.2.22, as amended by the applicant's response to RAI B.2.22-1, states an exception to the "detection of aging effects" program element. The exception states that the program is credited for detection of aging effects beyond those specified in the GALL Report. The staff reviewed this exception and the response to RAI B.2.22-1.

The staff finds the exception acceptable because the detection methods for loss of material due to corrosion for the additional metal materials are consistent with the methods for carbon steel, including the frequency of inspection, recommended in GALL AMP XI.M36, and the visual examination parameters discussed in the response to RAI B.2.22-1 are appropriate to detect the additional aging effects for the non-metal materials. Also, detection of aging due to hardening and loss of strength for fiberglass, elastomers, and thermoplastic components will be performed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which includes physical manipulation and testing of volumetric properties of these materials.

Enhancement 1. LRA Section B.2.22, as amended by the applicant's response to RAI B.2.22-1, states an enhancement to the "scope of program" program element. The applicant revised the enhancement, Commitment No. 17, and the FSAR supplement in response to RAI B.2.22-1 to delete two provisions of the enhancement related to changing the program implementing procedures to include the additional systems and components that credit the program for aging management and include the inspection attributes for the range of materials and aging effects within the scope of the program. The remaining portion of the enhancement stated that the applicant will revise procedures to ensure aging effects are managed for surfaces that are inaccessible or not readily available during operations or refueling outages.

On the basis of its review, the staff finds this enhancement acceptable because the two eliminated enhancements are adequately addressed by the addition of the three new exceptions discussed above, and the remaining enhancement ensures that inaccessible or not readily available surfaces will be inspected for aging effects.

Enhancement 2. LRA Section B.2.22 stated an enhancement to the "parameters monitored or inspected" program element. By letter dated October 13, 2009, the applicant deleted this enhancement. This enhancement had been intended to enhance procedures to detect aging effects consistent with the range of components crediting the program. The enhancement further stated that aging effects such as loss of material, hardening, loss of strength, and reduction of heat transfer would be included in the procedure.

On the basis of its review, the staff finds the applicant's deletion of this enhancement acceptable because these items have been included in Exceptions 2 and 3 and within the scope of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Enhancement 3. LRA Section B.2.22 states an enhancement to the "detection of aging effects" program element. The applicant stated that the program will be enhanced to include inspection attributes related to deterioration of coatings. The enhancement also stated that inspection of the inaccessible surfaces of components is also applicable to this program element.

The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M36. The staff noted that GALL AMP XI.M36 includes recommendations to inspect coatings for signs of degradation as an indicator to metal damage and to inspect components in inaccessible areas. The staff finds this enhancement acceptable because it will make the program consistent with the recommendations in GALL AMP XI.M36.

Based on its audit and review of the External Surfaces Monitoring Program, and the applicant's responses to RAIs B.2.22-1 and B.2.23-1, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the three exceptions associated with the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements and their justifications, and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 17, prior to the period of extended operation, would make the existing AMP consistent with GALL AMP XI.M36.

Operating Experience. LRA Section B.2.22 summarizes operating experience related to the External Surfaces Monitoring Program. The applicant stated that the program has been effective in managing the aging effects of loss of material. The applicant stated that system folders are maintained documenting information regarding system health, including performance monitoring and results of system walkdowns. The applicant also stated that action requests are initiated as needed to identify and resolve deficiencies, including material condition deficiencies. The applicant further stated that effectiveness of the system monitoring and walkdown programs has been assessed in multiple self-assessments that included timeliness, frequency, documentation, training, and overall effectiveness and that the assessments have concluded that the program is being effectively implemented.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application and the applicant's response to RAI B.2.22-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

<u>FSAR Supplement</u>. LRA Section A.1.1.22 provides the FSAR supplement for the External Surfaces Monitoring Program. The applicant revised its FSAR supplement by letter dated October 13, 2009, as a result of its response to RAI B.2.22-1. The staff reviewed this FSAR supplement description of the program, as amended, and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed (Commitment No. 17) to enhance the External Surfaces Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance the program to: (1) incorporate measures to assure the integrity of surfaces that are inaccessible or not readily visible during both plant operations and refueling outages, and (2) incorporate inspection attributes for degradation of coatings.

The staff determines that the information in the FSAR supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 17 prior to the period of extended operation would make the existing AMP consistent with the GALL Report to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes

that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Lubricating Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.2.24 describes the existing Lubricating Oil Analysis Program as consistent, with an exception, with GALL AMP XI.M39, "Lubricating Oil Analysis." The applicant stated that the program ensures that the oil environment in mechanical systems is maintained to the required quality. The applicant also stated that the program maintains oil system contaminants, such as water and particulates, within acceptable limits, which preserves an environment not conducive to loss of material, cracking, flow blockage, or reduction of heat transfer. The applicant further stated that the program includes sampling and analysis of lubricating oil for contaminants, periodic oil changes for selected components conducted at fixed intervals, and particle counts and water checks on old oil prior to disposal.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M39. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M39.

The staff also reviewed the portions of the "parameters monitored or inspected" program element associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.2.24 states an exception to the "parameters monitored or inspected" program element. The applicant stated that its program does not include measurement of the flash point on a periodic basis and that flash point is only measured upon receipt inspection or on systems where a combustible gas may accumulate. The applicant further stated that the plant has no lube oil reservoirs where a combustible gas may accumulate and, therefore, the flash point test is unnecessary. The "parameters monitored or inspected" program element of GALL AMP XI.M39 recommends, for components that do not have regular oil changes, that the oil viscosity, neutralization number, and flash point are determined to verify that the oil is suitable for continued use. During its audit, the staff confirmed that the plant has no lube oil reservoirs where a combustible gas could accumulate and that flash point testing on inservice lubricating oil has been discontinued.

Based on its review, the staff finds the exception acceptable because the applicant conducts alternate tests, such as oil viscosity, neutralization number, and spectroscopy, to identify contamination of infrequently changed oils. In addition, the staff finds the exception acceptable because the plant has no lube oil reservoirs where a combustible gas could accumulate.

On the basis of its audit and review of the applicant's Lubricating Oil Analysis Program, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the exception associated with the "parameters monitored or inspected" program element, and its justification, and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.24 summarizes operating experience related to the Lubricating Oil Analysis Program. The applicant stated that one example of plant-specific operating experience involves the discovery, through a routine lubricating oil sample, of visible ferrous wear debris from a circulating water pump. As a result, pump operation was restricted until the pump motor could be refurbished or replaced. The applicant also stated that another example of plant-specific operating experience involves the discovery of a discolored lubricating oil sample collected following replacement of a decay heat pump rotating assembly. It was suspected that this discolored sample was due to break-in wear of the pump bearings and, as a result, the oil sample was sent to the vendor for further analysis. The applicant further stated that a work order was issued to drain, flush, and refill the pump bearing reservoir, and an increased monitoring frequency was initiated until wear particle analyses returned to normal.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effect of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.24 provides the FSAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2. The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Lubricating Oil Analysis Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Masonry Wall Program

Summary of Technical Information in the Application. LRA Section B.2.29 describes the existing Masonry Wall Program as consistent, with an enhancement, with GALL AMP XI.S5, "Masonry Wall." This program will manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation. The applicant stated that the program includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. The included walls within the scope of this program are the masonry walls within the auxiliary building, control complex, turbine building, fire service pumphouse, and the switchyard relay building. The applicant also stated that the masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S5. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.S5.

The staff noted that the Masonry Wall Program consists of visual inspections for cracking in joints, deterioration of penetrations, missing or broken blocks, and missing mortar.

The staff noted during its review that the inspection frequency for structures within the scope of the Masonry Wall Program had not been described. Therefore, by letter dated November 30, 2010, the staff issued RAI B.2.29-1 requesting the applicant explain how the interval for inspections for the Masonry Wall Program will ensure that there is no loss of intended function for the components within the scope of the program. Pending receipt and review of the applicant's response, this issue has been identified as **OI-3.0.3.2.13-1.**

The staff also reviewed the portions of the "scope of program" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement. LRA Section B.2.29 states an enhancement to the "scope of program" program element. The applicant stated that an enhancement will be made to revise the program administrative controls procedure to identify the structures that have masonry walls within the scope of license renewal.

The staff reviewed the applicant's Masonry Wall Program and the corresponding aging effects requiring management under the "scope of the program" program element. The staff noted that the "scope of program" program element of GALL AMP XI.S5 states that the scope includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. The staff finds this enhancement acceptable because when it is implemented, the applicant's Masonry Wall Program will be consistent with GALL AMP XI.S5 and its administrative controls procedures will specifically identify those structures that include masonry walls within the scope of license renewal.

Based on its audit, and pending resolution of OI-3.0.3.2.13-1, the staff finds that elements one through six of the applicant's Masonry Wall Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.S5 and, therefore, acceptable.

Operating Experience. LRA Section B.2.29 summarizes operating experience related to the Masonry Wall Program. During the audit, the staff reviewed the "Operation Experience Review

Report (Masonry Walls)" and interviewed the applicant's technical staff to confirm that the plant-specific operating experience has been reviewed by the applicant and was evaluated as intended in the GALL Report. During its audit and walkdown, the staff found some minor indications that did not affect the structural integrity of any of the structures reviewed. In addition, the staff confirmed that the applicant addressed operating experience identified after issuance of the GALL Report. The staff notes that the applicant's program, with the corrective actions and enhancements discussed in the LRA, has been effective in identifying, monitoring, and correcting the aging effects of masonry walls. The staff also confirmed that plant-specific operating experience did not reveal any degradation not bounded by industry experience (i.e., no previously unknown aging effects were identified by the applicant or the staff).

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.29 provides the FSAR supplement for the Masonry Wall Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

The staff also notes that the applicant committed (Commitment No. 19) to enhance the Masonry Wall Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program administrative controls to identify the structures that have masonry walls within the scope of license renewal.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Masonry Wall Program, pending resolution of OI-3.0.3.2.13-1, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed one enhancement and confirmed that its implementation through Commitment No.19 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.30 describes the existing Structures Monitoring Program as consistent, with enhancements, with GALL AMP XI.S6, “Structures Monitoring Program.” The applicant stated that the Structures Monitoring Program is implemented through procedures in accordance with the Maintenance Rule; 10 CFR 50.65 addressed in NRC RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Revision 2; and NEI 93-01, “Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Revision 2. The applicant also stated that the program incorporated criteria recommended by the INPO Good Practice document 85-033, “Use of System Engineers” ; NEI 96-03, “Guidelines for Monitoring the Condition of Structures at Nuclear Plants”; inspection guidance based on industry experience and recommendations from ACI 349.3R-96, “Evaluation of Existing Nuclear Safety-Related Concrete Structures”; and American Society of Civil Engineers (ASCE) 11-90, “Guideline for Structural Condition Assessment of Existing Buildings.” The applicant further stated that the program implements periodic inspections and monitors the condition of structures and structural component supports to ensure that aging degradation leading to loss of intended functions will be detected and that the extent of degradation can be determined. In LRA Table 3.5.1 (item 25), the applicant stated that protective coatings are not relied upon to manage the effects of aging for structures in the Structures Monitoring Program.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.S6. As discussed in the Audit Report, the staff confirmed that the applicant’s “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements are mostly consistent with the corresponding program elements of GALL AMP XI.S6. However, the staff required additional information with regards to inspection frequencies in order to verify complete consistency.

As described in the operating experience discussion in LRA Section B.2.30, the Structures Monitoring Program is an existing program, and currently the frequency of inspection is 10 years. In the LRA, the applicant stated that the Structures Monitoring Program is consistent with the GALL Report. During its audit, the staff noted that the applicant’s program basis document states that the inspection criteria provided within the Structures Monitoring Program are primarily taken from ACI 349.3R-96 which is consistent with the GALL Report recommendation. The staff noted the 10-year inspection frequency for all SCs is not in conformance with ACI 349.3R-96, Chapter 6. However, the staff also noted that ACI 349.3R-96 states that the frequency should provide assurance that any age-related degradation is detected at an early stage and that appropriate mitigative actions can be implemented. By letter dated September 11, 2009, the staff issued RAI B.2.30-1 requesting that the applicant justify the frequency of the inspection interval of 10 years.

In its response dated October 13, 2009, the applicant provided an explanation for determination of frequency of inspection for the Structures Monitoring Program. The applicant stated the inspection frequency or schedule is implemented by the "detection of aging effects" and "monitoring and trending" program elements. With reference to the "detection of aging effects" program element, the applicant stated that its corporate procedure provides sufficient detail to ensure that aging degradation will be detected before there is loss of intended function and uses the general guidance of ACI 349.3R-96, Chapter 6 but does not implement specific frequencies of 5 years that are in the Chapter 6 table. With reference to the "monitoring and trending" program element, the applicant stated that its procedure specifies that the inspection interval shall be commensurate with the safety significance of the structure and its condition but shall not exceed 10 years, which meets the intent of RG 1.160, Regulatory Position 1.5 and NUMARC 93-01. The applicant explained that in some cases, inspection frequencies were changed due to observation during plant walkdowns and cited the following examples: a specific inspection of a concrete wall of the spent fuel pool was added with a 1-year frequency to monitor any concrete crack growth, the walls of the decay heat vaults were added on a 1-year frequency to monitor water intrusion/seepage and the inspection of the interior of the RB (non-IWE/IWL components), and the east cable bridge inspection was changed to a 1-year frequency.

Based on its review, the staff finds the applicant's response to RAI B.2.30-1 is partially acceptable, however, it requires further information. The applicant provided clarification that it follows the general guideline of ACI 349.3R-96, Chapter 6 but not the table, and the staff finds this acceptable because ACI 349.3R-96 provides an acceptable basis. The staff noted that according to Chapter 6 of ACI 349.3R-96, in general, it is recommended that all safety-related structures be visually inspected at intervals not to exceed 10 years. The applicant's Structures Monitoring Program uses a methodology for determining the frequency of inspection commensurate with the safety significance of the structure and its condition but not exceeding 10 years. Also, the applicant confirmed that its inspection procedure ensures that aging effects will be detected before there is a loss of intended functions. For several structures, the applicant has increased the frequency of inspections based on the safety significance of the structure and its condition as described in the examples for the spent fuel pool wall, decay heat vaults, the interior of the RB, and the east cable bridge.

From the above examples, the staff finds that the applicant's plant-specific operating experience indicated that some structures needed more frequent inspections based on the observations made during plant walkdowns. With the current inspection frequency of more than 5 years, it is not clear from the applicant's response as to how aging degradation will be detected and quantified before there is a loss of intended function. After discussing this issue with the applicant during a conference call held December 23, 2009 (teleconference summary located in ADAMS at Accession No. ML100320036), the applicant committed to inspecting structures on a frequency of at least once every 5 years (Commitment No. 20, item 12) by letter dated March 3, 2010. This addresses the staff's concern because it aligns the applicant's inspection frequency with accepted industry standards. Based on industry operating experience, a 5-year or less inspection interval will adequately detect degradation before there is a loss of intended function. The staff finds the applicant's approach regarding inspection intervals acceptable, and the staff's concern in RAI B.2.30-1 is resolved.

As part of Commitment No. 20, items 4 and 5, the applicant committed to a 5-year frequency of inspection for the water control structures (i.e., circulating water intake structures (including the submerged portion), circulating water discharge structure, nuclear service sea water discharge structure, intake canal, and raw water pit) which will be implemented prior to the period of extended operation. The applicant committed (Commitment No. 20, item 3) to groundwater chemistry monitoring including consideration for potential seasonal variations. By letter dated

October 13, 2009, the applicant responded to RAI B.2.30-3 stating that groundwater chemistry monitoring for the Structures Monitoring Program will be established starting in 2011, again in 2015 prior to the period of extended operation, and yearly starting in 2017 for the period of extended operation. For the structures identified to have degradation and/or water leaks, the 1-year frequency will continue during the period of extended operation.

Based on the above discussion, the staff finds the existing procedure is adequate to determine the inspection frequency because plant operating experience has indicated inspection intervals (i.e., as degradation has been detected, the inspection interval has been decreased to capture any subsequent degradation). The staff verified that the corporate procedure of CR-3 meets the requirements of RG 1.160, Regulatory Position 1.5, and 10 CFR 50.65(a)(1) and (a)(2). With the additional commitments, the staff finds the applicant's procedures appropriate, and the staff's remaining concerns described in RAI B.2.30-1 are resolved.

The applicant included "Inspection of Water-Control Structures Associated with Nuclear Power Plants" in its Structures Monitoring Program. However, during the audit, the staff did not find a program-element-by-program-element comparison of its Structures Monitoring Program with GALL AMP XI.S7 in the applicant's program basis document. By letter dated September 11, 2009, the staff issued RAI B.2.30-2 requesting additional information to determine that all program elements of its Structures Monitoring Program have incorporated the corresponding attributes of GALL AMP XI.S7.

In its response dated October 13, 2009, the applicant provided a program-element-by-program-element comparison of its Structures Monitoring Program with GALL AMP XI.S7.

Based on its review, the staff finds the applicant's response to RAI B.2.30-2 acceptable because the applicant provided a program-element-by-program-element comparison of its Structures Monitoring Program and GALL AMP XI.S7, and the staff was able to confirm that the applicant's Structures Monitoring Program incorporates the attributes of GALL AMP XI.S7. The staff's concern described in RAI B.2.30-2 is resolved.

The staff noted during its review that the LRA discussed ACI 349.3R as a reference for the Structures Monitoring Program, but it did not commit to the quantitative acceptance criteria, or clearly identify plant-specific quantitative acceptance criteria for Structures Monitoring Program inspections. Therefore, by letter dated November 30, 2010, the staff issued RAI B.2.30-6 requesting that the applicant provide the quantitative acceptance criteria for the Structures Monitoring Program. Pending receipt and review of the applicant's response, this issue has been identified as **OI-3.0.3.2.14-1.**

The staff also reviewed the portions of the "scope of program" and "parameters monitored/inspected" program elements associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of the enhancements follows.

Enhancement 1. In LRA Section B.2.30, the applicant included enhancements to the "scope of program" as listed below:

Administrative controls that implement the program will be revised to:

- specifically identify all license renewal structures and systems that credit the program for aging management in the corporate procedure for condition monitoring of the structures

- require notification of the responsible engineer when below-grade concrete including concrete pipe is exposed so that an inspection may be performed prior to backfilling

- require periodic inspections of the water control structures (circulating water intake structure, circulating water discharge structure, nuclear service sea water discharge structure, intake canal, and raw water pits) on a frequency not to exceed 5 years

- require periodic inspections on the submerged portions of the circulating water intake structure on a frequency not to exceed 5 years

- require periodic groundwater chemistry monitoring including consideration for potential seasonal variations

- require inspection of inaccessible surfaces of reinforced concrete pipe when exposed due to removal of backfill for any reason in the corporate procedure for condition monitoring of structures

- include additional in-scope structures and specific civil/structural commodities in the periodic engineering activity

The staff noted that the enhancements to the "scope of program" program element include periodic groundwater chemistry monitoring. However, the frequency of the groundwater chemistry monitoring was not specified. Therefore, by letter dated September 11, 2009, the staff issued RAI B.2.30-3 requesting that the applicant provide additional information about the following: past and present groundwater monitoring activities at CR-3, the current groundwater monitoring frequency and the frequency of groundwater monitoring under the period of extended operation, the location(s) where test samples were/are taken relative to the safety-related and important-to-safety embedded concrete foundations, seasonal variations, and the technical basis and acceptance criteria.

In its response dated October 13, 2009, the applicant provided a historical background associated with the radiological environmental monitoring program (REMP), as well as results of the groundwater chemistry testing performed in 2007 as depicted in LRA Table 3.0-1. The results indicated the groundwater to be non-aggressive, as defined in the GALL Report. The applicant indicated that the groundwater monitoring for the Structures Monitoring Program has not been implemented yet. However, prior to the period of extended operation, in the years 2011 and 2015, CR-3 will perform groundwater chemistry analysis with samples from two wells used for the Structures Monitoring Program. From 2017, the groundwater chemistry analysis for structures monitoring will be performed on a yearly basis, and the 1-year frequency will be continued during the period of extended operation. Moreover, the applicant stated that the 10 shallow wells are located below the berm and surround CR-3 and the distance of the wells vary from 150 feet to 525 feet from the safety-related structures located on the berm. The future samples will be collected from 2 out of these 10 shallow wells. CR-3 will follow the GALL Report and NUREG-1557 as a basis for non-aggressive groundwater chemistry having a pH greater than 5.5, chloride concentration less than 500 parts per million (ppm), and sulfate concentration less than 1,500 ppm. The test results will be provided to CR-3 engineering to trend the results. If the results indicate aggressiveness, corrective actions to investigate the results will be initiated.

Based on its review, the staff finds the applicant's response to RAI B.2.30-3 acceptable because the applicant's plan for groundwater monitoring during the period of extended operation is consistent with the GALL Report recommendations for non-aggressive groundwater limits, frequency for monitoring, and monitoring seasonal variation. The staff's concern described in RAI B.2.30-3 is resolved.

With the enhancements, the applicant's Structures Monitoring Program will include all the structures that are within the scope of license renewal. Based on its review of the above enhancements and the information provided in the applicant's response to RAI B.2.30-3, the staff finds these program enhancements acceptable because the "scope of program" program element for the existing Structures Monitoring Program when enhanced will be consistent with the recommendations in GALL AMP XI.S6.

Enhancement 2. In LRA Section B.2.30, the applicant included enhancements to the "parameters monitored or inspected" as listed below:

Administrative controls that implement the program will be revised to:

- identify additional civil/structural commodities along with the associated inspection attributes and performance standard required for license renewal in the corporate procedure for condition monitoring of structures

- require notification of the responsible engineer when below-grade concrete including concrete pipe is exposed so an inspection may be performed prior to backfilling

- require inspection of inaccessible surfaces of reinforced concrete pipe when exposed due to removal of backfill for any reason; this will be incorporated in the corporate procedure for condition monitoring of structures

- identify additional inspection criteria for structural commodities in the site system walkdown checklist

- add corrosion to the inspection criteria for the bar racks at the circulating water intake structure as a periodic maintenance activity

- add an inspection of the earth for loss of form and loss of material for the wave embankment protection structure in the periodic engineering activity

- require inspection of the Fluorogold® slide bearing plates used in the structural steel platform located in the reactor building on an established frequency

With the enhancements, the applicant's Structures Monitoring Program will identify the inspection criteria and performance standard for the SCs that are included within the scope of license renewal. The staff notes that these enhancements will ensure that age-related degradation leading to loss of intended functions will be detected and the extent of degradation will be determined. Review of the above enhancements and the information provided in the applicant's response to RAI B.2.30-3, the staff finds these program enhancements acceptable because the existing Structures Monitoring Program will be consistent with the recommendations in GALL AMP XI.S6.

Based on its audit and review, pending resolution of OI-3.0.3.2.14-1, the staff finds that elements one through six of the applicant's Structures Monitoring Program, with the enhancements discussed above, are consistent with the corresponding program elements of GALL AMPs XI.S6 and XI.S7 and, therefore, acceptable.

Operating Experience. LRA Section B.2.30 summarizes operating experience related to the Structures Monitoring Program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The applicant stated that a baseline inspection of structures was completed in 1997 and a subsequent inspection was completed in 2007. The LRA states that the survey of the intake canal is done on a minimum frequency of every 4 years. According to the applicant's inspection report of 2007, the inspection did not identify any significant degradation that impacted the intended functions of the structures and structural components. The staff noted that corrosion of steel components was identified on equipment supports of the sea water room. Furthermore, material for several supports has been changed to stainless steel. Corrosion of the east cable bridge was identified, and the inspection frequency has been adjusted to a yearly interval. The applicant claimed that these examples demonstrate that though the applicant has chosen a 10-year inspection interval for monitoring of structures, depending on the actual findings, the interval had been adjusted on a case-by-case basis. The staff found this reasoning unacceptable to justify the 10-year inspection interval. However, as discussed in the resolution of RAI B.2.30-1, the applicant committed (Commitment No. 20) to 5-year inspection intervals for most of the structures within the scope of license renewal.

The staff noted that there is a hairline crack in the spent fuel pool south wall, and the applicant has concluded in the inspection report to inspect and monitor it on a yearly interval. During its audit, the staff performed a walkdown on July 15, 2009, and found this hairline crack location at elevation 143 foot was dry at that time. The staff also walked down the leak chase channel drain points to ensure that the leak chase channel system is functioning. The staff noted one of the pipe ends appeared to contain mineral deposition and there was blockage of the leak chase channels that can potentially cause leakage of the borated water from the spent fuel through the floor and walls of the spent fuel pool. By letter dated September 11, 2009, the staff issued RAI B.2.30-5 requesting that the applicant provide a summary of the daily records of the leakage data collected at its spent fuel leak chase channel piping. Specifically, the staff requested that the applicant provide information about the time frame when initial leakage of the leak chase piping stopped and the actions that were taken to clean the leak chase piping.

In its response dated October 13, 2009, the applicant stated that its operating logs around July 15, 2009, recorded several of the leak chase lines as having ongoing leakage on the order of less than 1 drop per minute. However, the applicant observed that some leak chase channels had accumulation of boron at the outlet, but did not find any indication that the leak chase line was plugged. The applicant performed maintenance activities subsequent to the June 15, 2009, walkdown when it cleaned the leak chase outlet and confirmed that the lines were not plugged. The applicant further noted that pursuant to IN 2004-05, after the spent fuel pool leakage to onsite groundwater at Salem, an investigation was performed. As a part of the applicant's investigation, a snake was run up each of the 19 leak chases to verify they were clear. The applicant initiated preventive maintenance activities to periodically verify each of the leak chases are clear and also include analysis of samples of deposits removed to check for products of concrete degradation. The staff noted that operating experience for spent fuel pool leakage identified that the leakage is minimal at the lower end of the spent fuel pool "normal" water level range, but the leakage increases when the level is raised to the upper end of the "normal" range. Based on this experience, the applicant maintains the pool level to minimize liner leakage at a very low level.

Based on its review, the staff finds the applicant's response to RAI B.2.30-5 acceptable because in the context of IN 2004-05, the applicant verified that the leak chases were clear and implemented preventive maintenance activities which demonstrate that the effects of aging of the leak chase channels will be adequately managed.

The staff also walked down the tendon access gallery during its audit. The staff noted that various concrete degradation mechanisms were observed on the walls of the tendon access gallery at elevation 75 foot. The staff noted aging effects include cracking, leaching, blistering, and voids. Also, there was water on the floor at several places. The staff noted that according to the engineering inspection report in the program basis document, the condition is acceptable, and no corrective action is required. By letter dated September 11, 2009, the staff issued RAI B.2.30-4 requesting an explanation how the effects of aging will be adequately managed so that the intended function of protecting the tendon anchorage hardware against corrosion will be maintained consistent with the CLB for the period of extended operation without taking any corrective action.

In its response dated October 13, 2009, the applicant stated that it performed the Structures Monitoring Program visual inspection of the tendon access galley on April 24, 2007. Later in October/November 2007, the applicant also visually inspected this area in accordance with the ASME Section XI, Subsection IWL Program. The applicant claimed that both inspections met the acceptance criteria of the implementing procedure and did not require any corrective action.

During its audit, the staff performed a walkdown on July 15, 2009, and observed several deposits on the wall. The staff noted that earlier in March 2003, the deposits on the walls were analyzed and the analysis identified the white deposit, brown deposit, and stalactite deposit as calcium carbonate (greater than 98 percent) with iron (less than or equal to 0.04 percent) and pH 10.5 and 10.7. The staff further noted the shiny white hard caulk-like material was identified as 80 percent silica, 16 percent potassium, 0.80 percent calcium, 0.04 percent iron and pH of 11.4.

After the staff's audit, the applicant took samples on August 6, 2009, and the results indicated that the leached white deposits and brown deposits were calcium carbonate (greater than 95 percent), and the stalactite deposit was predominantly calcium carbonate (greater than 80 percent) with iron content ranging from 0 percent to 0.7 percent and pH 9.5 to 10. The applicant noted that the shiny white hard caulk-like material was identified as 70 percent calcium carbonate and potassium carbonate, silicon oxide, and potassium chloride, and pH 10.5. Furthermore, water from the samples was tested for sulfates and chlorides, which had results that showed high (1,300 ppm) chloride in the stalactite deposit.

On October 29, 2009, during a conference call with the applicant, as documented in the teleconference summary dated January 4, 2010, the staff sought input from the applicant on likely causes for the high chloride results in that sample. Also in response to RAI B.2.30-4, the applicant stated that, "The degree to which concrete will provide satisfactory protection for embedded steel reinforcement depends in most cases on the quality of the concrete and the depth of concrete over the steel." The staff sought clarification on how that statement is affected by the degradation mechanisms noted, both in the audit walkdown and previous Structures Monitoring Program inspections.

Based on the discussions during the conference call, the applicant supplemented its response to RAI B.2.30-4 by letter dated December 30, 2009. In this supplemental response, the applicant committed to add a civil/structural item to the One-Time Inspection Program. The inspection will involve taking core samples of concrete from the tendon access gallery wall where leaching has been observed. The applicant further stated that the sample will be taken from the inside face of the concrete up to the rebar. The cores will be tested to determine if water soluble chlorides that could lead to corrosion of the embedded steel are present. Exposed rebar will be examined for any significant corrosion.

Based on its review, the staff finds the applicant's response to RAI B.2.30-4 acceptable, because the testing and inspection discussed in the response will provide adequate assurance that the concrete has not degraded and will continue to perform its function during the period of extended operation. If any degradation is found during the inspection, it will be entered into the applicant's corrective action program and addressed prior to the period of extended operation. The staff finds the applicant's approach in resolving this issue acceptable, and the staff's concern in RAI B.2.30-4 is resolved.

During the staff's review of the LRA, the applicant notified the NRC of a delamination in the concrete of the containment structure. This issue was the subject of NRC Event Notification 45416, dated October 7, 2009, and NRC Special Inspection Team Press Release No. 11-09-055, dated October 9, 2009. The impacts of the event on license renewal are addressed in detail in the ASME Section XI, Subsection IWE and IWL Program write-ups, SER Sections 3.0.3.1.13 and 3.0.3.1.14, respectively. The root cause of the delamination was determined to be unique to the containment structure; therefore, the event does not have an impact on the staff's review of the Structures Monitoring Program.

Based on its audit, review of the application, and review of the applicant's responses to RAIs B.2.30-4 and B.2.30-5, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

In summary, the applicant committed (Commitment No. 20) to enhance the Structures Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program to: (1) identify all license renewal structures and systems that credit the program for aging management in the corporate procedure for condition monitoring of structures, (2) require notification of the responsible engineer when below-grade concrete including concrete pipe is exposed so an inspection may be performed prior to backfilling, (3) require periodic groundwater chemistry monitoring including consideration for potential seasonal variations, (4) require periodic inspections of the water control structures (i.e., circulating water intake structure, circulating water discharge structure, nuclear service sea water discharge structure, intake canal, and raw water pits) on a frequency not to exceed 5 years, (5) require periodic inspections of the circulating water intake structure submerged portions on a frequency not to exceed 5 years, (6) identify additional civil/structural commodities and associated inspection attributes and performance standard required for license renewal in the corporate procedure for condition monitoring of structures, (7) identify additional inspection criteria for structural commodities in the site system walkdown checklist, (8) add inspection for corrosion to the inspection criteria for the bar racks at the circulating water intake structure as a periodic maintenance activity, (9) add an inspection of the earth for loss of form and loss of material for the wave embankment protection structure as a periodic maintenance activity, (10) include additional in-scope structures and specific civil/structural commodities in periodic maintenance activities, and (11) require periodic inspections of the Fluorogold® slide bearing plates used in structural steel platform applications in the RB.

FSAR Supplement. LRA Section A.1.1.30 provides the FSAR supplement for the Structures Monitoring Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2. The applicant included inspection of water-control structures in its Structures Monitoring Program which is acceptable per the recommendations of the GALL Report. The staff verified that the applicant has added enhancements which are consistent with the program description of water-control structures in SRP-LR Table 3.5-2. The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The applicant stated that the program enhancement will be implemented prior to entering the period of extended operation (Commitment No. 20).

Conclusion. On the basis of its audit and review of the applicant's Structures Monitoring Program, pending resolution of OI-3.0.3.2.14-1, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 20 prior to the period of extended operation would make the existing AMP consistent with GALL AMPs XI.S6 and XI.S7 to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Fuse Holder Program

Summary of Technical Information in the Application. LRA Section B.2.35 describes the new Fuse Holder Program as consistent, with an exception, with GALL AMP XI.E5, "Fuse Holders." The applicant stated that the Fuse Holder Program is credited for the aging management of fuse holders located outside of active devices that are susceptible to aging effects. The applicant also stated that the Fuse Holder Program focuses on the metallic clamp (or clip) portion of the fuse holder and the parameters monitored include corrosion and oxidation. The applicant further stated that identified fuse holders within the scope of license renewal will be tested at least once every 10 years. In addition, the applicant stated that testing may include thermography, contact resistance testing, or other appropriate testing to be determined prior to program implementation. Finally, the applicant stated that the first test for license renewal will be completed before the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E5. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.E5.

The staff also reviewed the portions of the "parameters monitored or inspected" program element associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.2.35 states an exception to the "parameters monitored/inspected" program element. The applicant stated that loss of continuity due to corrosion and oxidation will be managed by the Fuse Holder Program. The applicant also stated that fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, and chemical contamination are not applicable aging effects for fuse holders located outside of active devices.

The staff noted that the "parameters monitored/inspected" program element of GALL AMP XI.E5 recommends the monitoring of thermal fatigue in the form of high resistance caused by ohmic heating, thermal cycling or electrical transients, mechanical fatigue caused by frequent removal/replacement of the fuse or vibration, chemical contamination, corrosion, and oxidation. The staff also noted that the applicant did not provide a justification as to why fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, and chemical contamination are not applicable aging effects for fuse holders located outside of active devices. By letter dated September 11, 2009, the staff issued RAI B.2.35-1 requesting that the applicant provide a justification as to how its Fuse Holder Program will adequately manage the aging effects of the metallic clamp portion of fuse holders without monitoring thermal fatigue in the form of high resistance caused by ohmic heating, thermal cycling or electrical transients, mechanical fatigue caused by frequent removal/replacement of the fuse or vibration, or chemical contamination.

In its response dated October 13, 2009, the applicant stated that the fuse holders subject to an AMR are used in control valve and/or intermittent instrumentation and control applications. The applicant also stated that instrumentation and control circuits operate at such low currents that no appreciable thermal cycling or ohmic heating occurs. The applicant concluded that thermal cycling and ohmic heating apply to power supply applications, therefore, they are not considered applicable aging mechanisms for its fuse holders. The applicant further stated that mechanical stress due to electrical faults is not considered a credible aging mechanism since such faults are infrequent and random in nature. In addition, the applicant stated that stresses due to forces associated with electrical faults and transients are mitigated by fast action of circuit protective devices at high currents. The applicant also stated that its fuses are not routinely pulled and/or manipulated to facilitate plant testing. The applicant concluded that frequent manipulation is not considered an applicable aging mechanism. The applicant also performed plant walkdowns and verified that there are no direct sources of vibration for the fuse holder panels, and the panels are mounted separately to their own support structure on a concrete wall or column. The applicant concluded that vibration is not an applicable aging mechanism for its fuse holders. Plant walkdowns by the applicant also concluded that there are no potential sources of chemical contamination in the area and that fuse holders are totally enclosed in a protective junction box which would provide protection even if chemical contamination were possible.

Based on its review, the staff finds the applicant's response to RAI B.2.35-1 and this exception acceptable because the applicant's Fuse Holder Program has identified the applicable aging effects in GALL AMP XI.E5 and provided an adequate justification for the exception taken to GALL AMP XI.E5. The staff's concern described in RAI B.2.35-1 is resolved.

Based on its audit and review of the Fuse Holder Program, and the applicant's response to RAI B.2.35-1, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the exception associated with the "parameters monitored/inspected" program element, and its justification, and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Operating Experience. LRA Section B.2.35 summarizes operating experience related to the Fuse Holder Program. The applicant stated that this is a new AMP for fuse holders and, therefore, there is no existing site-specific operating experience to validate the effectiveness of the program. The applicant also stated that plant-specific and industry-wide operating experience was considered in the development of all electrical programs in LRA Appendix B. The applicant further stated that plant-specific operating experience for its Fuse Holder Program has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with engineering personnel and a review of work management records and applicable site correspondence. Based on its review, the applicant concluded that the operating experience discussed in the GALL Report is bounding (i.e., that there is no unique, plant-specific operating experience in addition to that in the GALL Report). Finally, the applicant stated that going forward, operating experience will be captured through its corrective action and operating experience programs implemented through its QA program in accordance with 10 CFR Part 50, Appendix B.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.35 provides the FSAR supplement for the Fuse Holder Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 25) to implement the new Fuse Holder Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Fuse Holder Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. LRA Section B.2.36 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent, with exceptions, with GALL AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that the program will be implemented as a one-time inspection on a representative sample of non-EQ cable connections within the scope of license renewal prior to the period of extended operation. The applicant further stated that the specific type of test performed will be determined prior to testing and is to be a proven test for detecting loose connections, such as thermography, contact resistance testing, or other appropriate testing judged to be effective in determining cable connection integrity. The applicant also stated that the program does not include high-voltage (greater than 35 kV) switchyard connections. The applicant concluded that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will provide reasonable assurance that the electrical connections within the scope of license renewal will be maintained consistent with the CLB through the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E6. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E6, with the exception of the program description. For the program description, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted the program description for the applicant's program states that it does not include high-voltage connections; however, when describing the factors that are considered for sampling, high-voltage connections are included. The staff noted that GALL AMP XI.E6 includes the sampling of high-voltage connections in its program description. The staff further noted that an exception is not identified by the applicant regarding high-voltage connections. By letter dated November 3, 2009, the staff issued RAI B.2.36-1 requesting that the applicant clarify the voltages included in the sample selection for its program and the associated basis document as required.

In its response dated December 3, 2009, the applicant stated that:

> NUREG-1801, Rev. 1, AMP XI.E6 states that the following factors are to be considered for sampling: application (high, medium and low voltage), circuit loading, and location (high temperature, high humidity, vibration, etc.). However, consistent with the sampling criteria provided in proposed LR-ISG-2007-02, dated August 29, 2007, CR-3 shall consider the following factors for sampling: voltage level (medium and low voltage), circuit loading (high load), and location (high temperature, high humidity, vibration, etc.).

The applicant amended the sample selection and application factors of LRA Sections A.1.1.36 and B.2.36 to not include high-voltage connections. In addition, the applicant amended LRA Section B.2.36 to incorporate an additional exception (Exception 3) as documented below. Based on its review, the staff finds the applicant's response to RAI B.2.36-1 acceptable because the applicant amended its LRA so that LRA Sections A.1.1.36 and B.2.36 are consistent with GALL AMP XI.E6 as modified by the Interim Staff Guidance (ISG) LR-ISG-2007-02, "Changes to generic aging lessons learned (GALL) Report Aging Management Program (AMP) XI.E6, 'Electrical Cable Connections Not Subject to 10 CF 50.49 Environmental Qualification Requirements'," for the program description and the "parameters monitored/inspected" program element. The staff's concern described in RAI B.2.36-1 is resolved.

Exception 1. LRA Section B.2.36 states an exception to the "scope of program" program element. The applicant stated that it has applied the clarification provided in LR-ISG-2007-02 dated August 29, 2007, that revises the scope to include only external cable connections terminating at an active device such as a motor, motor control center, switchgear, or of a passive device such as a fuse cabinet. The applicant further stated that wiring connections internal to an active assembly installed by manufacturers are considered a part of the active assembly and, therefore, are not within the scope of this program. The staff noted that the "scope of program" program element of GALL AMP XI.E6 recommends that connections associated with cables within the scope of license renewal are part of this program, regardless of their association with active or passive components.

The staff reviewed the exception including information provided in the LRA and finds the exception to the "scope of program" program element acceptable because the applicant incorporated the program element changes as exceptions to GALL AMP XI.E6 consistent with the staff guidance in LR-ISG-2007-02. LR-ISG-2007-02 is a staff effort to clarify industry operating experience associated with GALL AMP XI.E6 with electrical cable connections. LR-ISG-2007-02 addresses the applicant's proposed changes to GALL AMP XI.E6. The staff finds this exception acceptable because the applicant's program is consistent with the "scope of program" program element of GALL AMP XI.E6 as modified by ISG LR-ISG-2007-02.

Exception 2. LRA Section B.2.36 states an exception to the "detection of aging effects" program element. The applicant stated that it is consistent with the test frequency flexibility provided in LR-ISG-2007-02; this element will be implemented as a one-time inspection on a representative sample of non-EQ cable connections within the scope of license renewal prior to the period of extended operation. The applicant also stated that inspection methods may include thermography, contact resistance testing, or other appropriate testing methods. The applicant further stated that this one-time inspection verifies that the loosening of connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an aging effect that requires a periodic AMP. The staff noted that in the "detection of aging effects" program element of GALL AMP XI.E6, it specifies that electrical connections within the scope of license renewal will be tested at least once every 10 years and testing may include thermography, contact resistance testing, or other appropriate testing methods.

The staff reviewed the exception including information provided in the LRA and finds the exception to the "detection of aging effects" program element acceptable because the applicant incorporated the program element changes as exceptions to GALL AMP XI.E6 consistent with the staff guidance in LR-ISG-2007-02. The staff finds this exception acceptable because the applicant's program is consistent with the "detection of aging effects" program element of GALL AMP XI.E6 as modified by ISG LR-ISG-2007-02.

Exception 3. By letter dated December 3, 2009, the applicant amended LRA Section B.2.36 to include an exception to the "parameters monitored/inspected" program element. The applicant stated that consistent with the sampling criteria provided in proposed LR-ISG-2007-02, it shall consider the following factors for sampling: voltage level (medium- and low-voltage), circuit loading (high load), and location (high temperature, high humidity, vibration, etc). The staff noted that the "parameters monitored/inspected" program element of GALL AMP XI.E6 specifies high-voltage connections as a factor to be considered in specifying a representative sample of electrical cable connections.

The staff reviewed the exception including information provided in the LRA and the applicant's response to RAI B.2.36-1 and finds the exception to the "parameters monitored/inspected" program element acceptable because the applicant incorporated the program element changes as exceptions to GALL AMP XI.E6 consistent with the staff guidance in LR-ISG-2007-02. The staff finds this exception acceptable because the applicant's program is consistent with the "parameters monitored/inspected" program element of GALL AMP XI.E6 as modified by ISG LR-ISG-2007-02.

Based on its audit and review of the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, and the applicant's response to RAI B.2.36-1, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the three exceptions associated with the "scope of the program," "detection of aging effects," and "parameters monitored or inspected," program elements, and their justifications, and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it.

<u>Operating Experience</u>. LRA Section B.2.36 summarizes operating experience related to the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The applicant stated that this is a new AMP with no specific operating experience history. The applicant also stated that plant-specific and industry-wide operating experience was considered in the development of LRA Appendix B, "Aging Management

Programs." The applicant further stated that plant-specific operating experience for cable connections has been captured by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site engineering personnel. In addition, the applicant stated that the operating experience also included a review of work management records, applicable site correspondence, and nuclear assessment section assessment records. Based on the applicant's review, the applicant concluded that there is no unique, plant-specific operating experience in addition to that in the GALL Report.

The staff reviewed the operating experience in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.36, as amended by letter dated December 3, 2009, provides the FSAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 26) to implement the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program prior to entering the period of extended operation for managing aging of applicable components.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and its justification and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Fuel Pool Rack Neutron Absorber Monitoring Program
- High-Voltage Insulators in the 230-kV Switchyard Program

For AMPs not consistent with, or not addressed in, the GALL Report, the staff performed a complete review to determine their adequacy to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Fuel Pool Rack Neutron Absorber Monitoring Program

Summary of Technical Information in the Application. LRA Section B.2.37 describes the Fuel Pool Rack Neutron Absorber Monitoring Program as an existing program that monitors the effects of aging on the neutron absorber panels in the high density spent fuel storage racks installed in the CR-3 spent fuel pools. The applicant stated that there are two sides to the spent fuel pool at CR-3, spent fuel pool A and B. Carborundum is the shielding material used as neutron absorbers for spent fuel pool A, and Boral is used in spent fuel pool B.

The applicant stated that the program calls for periodic removal and examination of Carborundum poison samples from spent fuel pool A to ensure that the effective neutron multiplication factor is maintained below 0.95. In addition, the applicant stated that the program performs Boron-10 areal density gauge for evaluation racks (BADGER) testing or comparable neutron attenuation testing in pools A and B to ensure that the spent fuel rack neutron absorber intended function is maintained.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.2.37 on the applicant's demonstration of the Fuel Pool Rack Neutron Absorber Monitoring Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Fuel Pool Rack Neutron Absorber Monitoring Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements (i.e., "scope of the program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," "corrective actions," "confirmation process," "administrative controls," and "operating experience").

The applicant indicated that the “corrective actions,” “confirmation process,” and “administrative controls” program elements are parts of the site-controlled QA program. The staff’s evaluation of the QA program is discussed in SER Section 3.0.4. Evaluation of the remaining seven elements follows:

(1) LRA Section B.2.37 states that the scope of the program includes monitoring the effects of aging on the Carborundum panels in the high density spent fuel storage racks in spent fuel pool A and the Boral panels in the high density fuel storage racks in spent fuel pool B.

The staff reviewed the applicant’s “scope of program” program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs of which the program manages the aging.

The staff confirmed that the “scope of the program” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

(2) LRA Section B.2.37 states that the program is a condition monitoring program and no actions are taken to prevent or mitigate aging degradation.

The staff reviewed the applicant’s “preventive actions” program element against the criteria in SRP-LR Section A.1.2.3.2, which states that for condition or performance monitoring programs, it does not rely on preventive actions and thus, this information need not be provided.

The staff confirmed that the “preventive actions” program element satisfies the criterion defined by SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

(3) LRA Section B.2.37 states that the parameters monitored or inspected will verify that Carborundum sample coupons meet visual acceptance criteria and will be managed during the period of extended operation, and Carborundum sample weight loss shall be within acceptable criteria and will be managed during the period of extended operation. The inspections monitor Carborundum samples that have been exposed to either gamma radiation dose plus borated water or borated water alone to determine percentage weight loss of the sample. Based on the low percentage weight loss of Carborundum for sample inspections performed every 5 years, the inspection interval has been increased to nominally every 10 years.

CR-3 will perform periodic in-situ BADGER or comparable neutron attenuation testing of spent fuel racks in pool A and pool B to directly monitor the neutron absorption capabilities of Carborundum and Boral absorber materials in these racks.

The staff reviewed the applicant’s “parameters monitored or inspected” program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s).

In a letter dated October 2, 2009, the applicant stated that sample coupons located in spent fuel pool A (i.e., Carborundum sample coupons) will be monitored and inspected for material degradation. One set of coupons resides in a rack holder and the other in a wall holder. The applicant also stated that the techniques used to monitor for degradation include:

a. Visual (surface) inspection – once the samples have been removed, the first step is a visual inspection. The visual inspection looks for obvious signs of deterioration such as indication of B_4C grain loss, uniformity, spalling, voids, and backing or binder degradation. The sample is determined to be in one of six categories of deterioration.

b. Weight – After completion of the visual inspections, the sample coupons are dried and weighed. The drying is to remove excess water and return the samples to the state of the original, initial weigh in. Once weighted, the sample coupon weights are compared to the original, initial weights. The change in weight is presented in both actual weight change (gms) and percent weight change.

In the October 2, 2009, letter, the applicant further stated that when Boral spent fuel storage racks were installed in spent fuel pool B in 2001, there was no requirement to have a surveillance program for Boral. As such, the applicant stated that no sample coupons were inserted in spent fuel pool B, and no neutron absorber monitoring surveillance program was implemented. In addition, the applicant stated that the aging effects for Boral are insignificant and do not require aging management. The applicant based this on operating experience recorded for Progress Energy's CR-3 and Harris Nuclear plants and on the results of staff evaluations of the V.C. Summer Nuclear Station and the Brunswick Steam Electric Plant for these aging effects.

After reviewing the applicant's October 2, 2009, letter, the staff noted that the GALL Report cites both loss of material and loss of neutron-absorbing capacity as aging effects requiring management (AERMs) for neutron absorber materials. In addition, the staff and the applicant discussed the NRC issued ISG LR-ISG-2009-01, "Aging Management of Spent Fuel Pool Neutron-Absorbing Materials other than Boraflex," which reaffirmed the staff position that aging effects for stainless steel spent fuel storage racks and neutron absorber materials require management. As a result, the staff issued RAI 3.3.2.2.6-2 dated November 30, 2009, requesting that the applicant discuss the surveillance program that will be implemented for Boral used in spent fuel pool B during the period of extended operation.

In a letter dated January 27, 2010, the applicant stated that the initial title of the program described in LRA Section B.2.37, "Carborundum (B_4C) Monitoring Program," is revised to "Fuel Pool Rack Neutron Absorber Monitoring Program" and would manage the effects of aging for both Carborundum and Boral. The applicant also stated that a BADGER, or comparable, in-situ neutron attenuation test will be performed prior to the period of extended operation for spent fuel pools A and B (i.e., Carborundum and Boral panels). The applicant also stated that neutron attenuation testing will be repeated at 10-year intervals within the period of extended operation. In addition, the applicant stated that the BADGER testing will be staggered with the current sample coupon testing program so that a BADGER or a sample coupon test will occur every 5 years through the extended period of operation. The current sample coupon testing program includes removal, visual inspection, and weighing of Carborundum sample coupons from spent fuel pool A. In addition, since there are no sample coupons in spent fuel pool B, in-situ neutron attenuation methods (e.g., BADGER or another comparable testing method) will be used to determine if degradation of the Boral has occurred in representative areas of the spent fuel pool B racks.

After reviewing the “parameters monitored or inspected” program element, the staff determined that the applicant adequately addressed the criterion defined in SRP-LR Section A.1.2.3.3. Inspection of the Carborundum sample coupons, which are indicative of the Carborundum panels in spent fuel pool A, is an acceptable means to monitor for loss of material. Furthermore, the performance of BADGER testing in both spent fuel pools is an acceptable means to monitor for loss of material and neutron attenuation degradation. Therefore, the staff finds the “parameters monitored or inspected” program element acceptable.

(4) LRA Section B.2.37 states that the Carborundum panels within the scope of the program are to be inspected nominally every 10 years. The applicant stated that this is an adequate period to detect aging effects before a loss of component intended function. The applicant also stated that a 5-year nominal testing interval had been used up to 2004, and enough data has been accumulated to determine that the degradation (loss of material) rate is low enough to satisfy acceptance criteria through the period of extended operation.

In a letter dated January 27, 2010, the applicant stated that a BADGER, or comparable, in-situ neutron attenuation test will be performed prior to the period of extended operation for spent fuel pools A and B (i.e., Carborundum and Boral panels). The neutron attenuation testing will be repeated at 10-year intervals within the period of extended operation. In addition, the applicant stated that the BADGER testing will be staggered with the current sample coupon testing program so that a BADGER or a sample coupon test will occur every 5 years through the period of extended operation. The current sample coupon testing program includes removal, visual inspection, and weighing of Carborundum sample coupons from spent fuel pool A. In addition, since there are no sample coupons in spent fuel pool B, in-situ neutron attenuation methods (e.g., BADGER or another comparable testing method) will be used to determine if degradation of the Boral has occurred in representative areas of the spent fuel pool B racks.

The staff reviewed the applicant’s “detection of aging effects” program element against the criteria in SRP-LR Section A.1.2.3.4, which states that detection of aging effects should occur before there is loss of the SC intended function(s).

The parameters to be monitored or inspected should be appropriate to ensure that the SC intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new/one-time inspections to ensure timely detection of aging effects. Information should be provided that links the parameters to be monitored or inspected to the aging effects being managed.

After reviewing the “detection of aging effects” program element, the staff determined that the applicant adequately satisfied criterion defined in SRP-LR Section A.1.2.3.4. The detection of aging effects will occur before there is a loss of the SC intended function(s) because sample coupon testing and neutron attenuation testing (e.g., BADGER or another comparable testing method) are acceptable means to detect neutron absorber degradation and loss of material. Therefore, the staff finds the "detection of aging effects" program element acceptable.

(5) LRA Section B.2.37 states monitoring and trend data is incorporated in test procedures to be used to project and compare for upcoming sample testing. The applicant further stated that trending of discrepancies is also performed in accordance with the corrective action program. The applicant also stated that prior to the period of extended operation, program administrative controls will be revised to include provisions to monitor and trend data for incorporation in test procedures to ensure the projections meet acceptance criteria.

The applicant stated that neutron attenuation test results will be compared to baseline information or prior measurements and analysis and trended against previous test results.

The staff reviewed the applicant's "monitoring and trending program" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described and should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

By letter dated October 2, 2009, the applicant provided supplemental information regarding the CR-3 Carborundum coupon program. The applicant stated that there are two types of coupons in the coupon program used to monitor for degradation:

(1) Rack (gamma) samples – rack samples, also known as gamma samples, are located in the fuel racks. These sample coupons are attached to a fuel assembly shaped holder that is seated in the fuel rack like a fuel assembly. The sample packets consist of poison configuration, including a vent hole. There are 5 rack sample packets remaining. These samples will extend the surveillance program through the year 2053, which is beyond the extended period of operation for license renewal.

(2) Water samples – water samples are located well above the plane of the fuel, but still within the borated water environment of Spent Fuel Pool A, and are attached to the side of the pool. The samples packets consist of actual rack poison configuration, including a vent hole. There are 5 water sample packets remaining. These samples will extend the surveillance program through the year 2053, which is beyond the license renewal interval.

In a letter dated January 27, 2010, the applicant stated that a BADGER, or comparable, in-situ neutron attenuation test will be performed prior to the period of extended operation for spent fuel pools A and B (i.e., Carborundum and Boral panels). The neutron attenuation testing will be repeated at 10-year intervals within the period of extended operation. In addition, the applicant stated that the BADGER testing will be staggered with the current sample coupon testing program so that a BADGER or a sample coupon test will occur every 5 years through the period of extended operation. The current sample coupon testing program includes removal, visual inspection, and weighing of Carborundum sample coupons from spent fuel pool A. In addition, since there are no sample coupons in spent fuel pool B, in-situ neutron attenuation methods (e.g., BADGER or another comparable testing method) will be used to determine if degradation of the Boral panels have occurred in representative areas of the spent fuel pool B racks.

After reviewing the “monitoring and trending” program element, the staff determined that the applicant adequately satisfied the criterion defined in SRP-LR Section A.1.2.3.5. The performance of visual inspection and weighing of Carborundum sample coupons and the performance of BAGDER testing, or other comparable testing method, are acceptable means to monitor and trend neutron absorber degradation and, therefore, the staff finds the “monitoring and trending” program element acceptable.

(6) LRA Section B.2.37 states that inspection findings are to be within the acceptance criteria to ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation. The applicant stated that the program administrative controls contain the applicable acceptance criteria. The applicant also stated that the administrative controls will be revised to include accumulated weight losses of monitored Carborundum samples.

The applicant further stated that procedural controls for neutron attenuation testing will require evaluation to verify the ability of the fuel racks to perform their intended function through the next test interval and to ensure that criticality requirements of TS 3.7.14 and 3.7.15 are continually met. The staff finds this acceptable because the criticality requirements of TS 3.7.14 and 3.7.15 will continue through the period of extended operation.

By letter dated January 27, 2010, the applicant provided supplemental information regarding the CR-3 Carborundum coupon program and BADGER testing of spent fuel pools A and B, in response to RAIs. The applicant provided the following information:

(a) BADGER (or comparable neutron attenuation testing): The acceptance criteria will be established such that it assures the neutron attenuation assumptions of the current criticality analysis are met. The results will then be projected based on time and dose to the next performance interval to ensure the attenuation capabilities assumed in the criticality analysis are continually met through the period of extended operation.

(b) Acceptance criteria for the sample coupon test program are based on two aspects-visual inspection and weight loss. Visual inspections look for the general condition of the sample coupons ensuring no spalling, blistering or loss of grain material. Based on previous testing by the poison material vendor, weight loss can be correlated to boron loss, with a 20 percent weight loss equivalent to a 15 percent boron loss. A 15 percent loss has been assumed in the current criticality analysis that supports ITS [Improved Technical Specification] LCO [limiting condition for operation] 3.7.15.

(c) The acceptance criteria [for Boral spent fuel pool neutron attenuation testing] will be established such that it assures the neutron attenuation assumptions of the current criticality analysis are valid. The results will then be projected based on time and dose to the next performance interval to ensure the attenuation capabilities assumed in the criticality analysis are continually maintained.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance criteria.

After reviewing the "acceptance criteria" program element, the staff determined that the applicant adequately satisfied the criterion defined in SRP-LR Section A.1.2.3.6. The GALL Report identifies reduction of neutron-absorber capacity as an AERM for neutron absorber materials in PWR treated water. The applicant provided the acceptance criteria for neutron attenuation degradation and loss of material for Carborundum and Boral in CR-3 spent fuel pool water and, therefore, the staff finds the "acceptance criteria" program element acceptable.

(7) LRA Section B.2.37 summarizes operating experience related to the fuel pool rack neutron absorber monitoring. The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that the operating experience of AMPs, including past corrective actions resulting in program enhancements or additional programs, should be considered. A past failure would not necessarily invalidate an AMP because the feedback from operating experience should have resulted in appropriate program enhancements or new programs. This information can show where an existing program has succeeded and where it has failed (if at all) in intercepting aging degradation in a timely manner. This information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation.

The applicant stated that at CR-3, Carborundum neutron absorbers have been tested since 1984. The testing has been conducted on Carborundum sample coupons exposed to gamma dose and borated water. The applicant used a 5-year testing interval since 2004, and data has been accumulated to determine that the degradation rate is low enough to satisfy minimum neutron attenuation capability through the period of extended operation.

The applicant has increased the inspection interval frequency to nominally every 10 years due to low degradation rate. The applicant stated that the 2004 operating experience includes the following:

> During 2004, OE [operating experience] included a failed sample for a weight loss of 21 percent (compared to 4 percent to 5 percent for the comparable samples). It was determined that the weight loss was a result of the material loss adjacent to the sample packet vent hole. It was also determined that the vent holes were above the active fuel length, therefore degradation opposite the vent holes would not result in neutron streaming and would have no effect on reactivity. Therefore, there are no adverse consequences from material

> degradation opposite the holes. The Spent Fuel Pool A criticality analysis remains valid.

After reviewing the "operating experience" program element, the staff determined that more information was needed to accept the justification of extending the inspection interval from every 5 years to nominally every 10 years. Although the applicant has accumulated data that was used to determine degradation rate, the staff does not accept visual and weight inspections as true indications that the neutron attenuation degradation rate is low. The staff has determined that neutron attenuation testing is an acceptable means to evaluate neutron attenuation degradation. In addition, the staff determined that the information provided regarding the 21 percent failed sample was not adequate. As a result, the staff issued RAI B.2.37-2 dated November 30, 2009. In the RAI, the staff requested, based on current industry operating experience (e.g., BADGER testing of Carborundum plates at Palisades Nuclear Plant revealed degradation of neutron absorber materials exceeding TS requirements) and the 2004 failed sample with weight loss of 21 percent at CR-3, that the applicant provide additional justification for extending the surveillance inspections of the sample coupons to 10 years.

By letter dated January 27, 2010, the applicant provided supplemental information regarding the inspection interval and failed sample. The applicant stated the following:

> Crystal River Unit 3 had an average weight loss of less than seven percent at the last surveillance interval (from rack installation to 2004). The 11-year period from 1993 to 2004 had an increase in weight loss of less than 2%. There is an available weight loss margin of 13% with historical increases in weight loss of less than 2% per 10-year period. Additionally, the sample coupon weight loss measurement will be staggered with the BADGER in-situ neutron attenuation testing, which will also [be] on a 10-year test interval. The result will be a Spent Fuel Pool A rack poison surveillance test, either BADGER or sample coupon weight loss, every 5 years. The weight loss will be correlated to the BADGER in-situ neutron attenuation measurements to provide for more meaningful projections of rack poison status between test intervals and to modify the weight loss acceptance criteria if required.
>
> Regarding the 2004 failed sample with weight loss of 21 percent, the sample coupon with the greater than 21 percent loss is considered an anomaly in that the coupon experiencing the 21 percent weight loss is directly opposite the vent/inspection hole in the packet, and was believed to have been damaged (eroded) by water rinsing/lancing for decontamination during removal of the holder from the spent fuel pool.

The staff finds the applicant's response to RAI B.2.37-2 acceptable since the inspection frequency will include the performance of neutron attenuation testing at inspection intervals of 10 years, which is consistent with the recommendations found in ISG LR-ISG-2009-01. In addition, the staff has determined that the applicant has provided sufficient information to disposition the 21 percent failed sample coupon as an anomaly and not indicative of the Carborundum panels in the spent fuel pool.

In a letter dated October 2, 2009, the applicant stated that when the Boral spent fuel storage racks were installed in spent fuel pool B in 2001, there was no requirement to have a surveillance program for Boral. As such, the applicant stated that no sample coupons were inserted in spent fuel pool B, and no neutron absorber monitoring surveillance program was implemented. In the January 27, 2010, letter, the applicant stated that BADGER, or comparable, testing methods will be performed to monitor neutron absorber degradation. The applicant also stated that industry operating experience will be monitored, along with vender recommendations, to better implement the neutron attenuation testing. The BADGER, or comparable, testing will be initially performed prior to the period of extended operation and will be repeated at 10-year intervals within the period of extended operation.

Based on its review, the staff finds that the operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging in SSCs within the scope of the program, and the implementation of this program has resulted in the applicant taking corrective actions. Therefore, the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.1.37 provides the FSAR supplement for the Fuel Pool Rack Neutron Absorber Monitoring Program.

The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed to (Commitment No. 27) ongoing implementation of the existing Fuel Pool Rack Neutron Absorber Monitoring Program for managing aging of applicable components during the period of extended operation. Particularly, the applicant committed to enhance the administrative controls for the program prior to the period of extended operation. The applicant committed to:

(1) include provisions to monitor and trend data for incorporation in test procedures to ensure the projection meets the acceptance criteria

(2) incorporate acceptance criteria tables for accumulated weight losses of monitored Carborundum samples

(3) implement periodic BADGER testing or comparable neutron attenuation testing for racks in pools A and B to ensure that the neutron absorption intended function is maintained and that TS criticality requirements are continually met

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Fuel Pool Rack Neutron Absorber Monitoring Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 High-Voltage Insulators in the 230-kV Switchyard Program

Summary of Technical Information in the Application. LRA Section B.2.38 describes the new High-Voltage Insulators in the 230-kV Switchyard Program as plant-specific. The applicant stated that the High-Voltage Insulators in the 230-kV Switchyard Program is credited for the aging management of the high-voltage insulators used in the power path for the overhead transmission conductors that connect its 230-kV switchyard to the backup engineered safeguards transformer (BEST). The program inspects the insulators for salt deposits or surface contamination and mechanical wear of the steel hardware connecting the insulators to one another. The applicant stated that the high-voltage insulators within the scope of this program are to be inspected at least once every 4 years and the first inspections for license renewal are to be completed prior to the period of extended operation.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.2.38 on the applicant's demonstration of the High-Voltage Insulators in the 230-kV Switchyard Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the High-Voltage Insulators in the 230-kV Switchyard Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements (i.e., "scope of program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," "corrective actions," "confirmation process," "administrative controls," and "operating experience").

The applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements are parts of the site-controlled QA program. The staff's evaluation of the QA program is discussed in SER Section 3.0.4. Evaluation of the remaining seven elements follows:

(1) Scope of the Program – LRA Section B.2.38 states this program applies to high-voltage insulators used in the power path for the overhead transmission conductors that connect the CR-3 230-kV switchyard to the BEST.

    The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs of which the program manages the aging. The staff determined that the specific commodity groups for which the program manages aging effects are identified (high-voltage insulators used in the power path for the overhead transmission conductors that connect the CR-3 230-kV switchyard to the BEST), which satisfies the criterion defined in SRP-LR Appendix A.1.2.3.1.

    The staff confirmed that the "scope of the program" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions – LRA Section B.2.38 states that no actions are taken as part of this inspection program to prevent or mitigate aging degradation.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that condition monitoring programs do not rely on preventive actions and thus, preventive actions need not be provided. The staff notes that this is a condition monitoring program and finds it acceptable that there is no need for preventive actions, consistent with SRP-LR Section A.1.2.3.2.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected – LRA Section B.2.38 states that the following parameters will be monitored/inspected to ensure component intended function during the period of extended operation: (a) evidence of salt deposits or surface contamination, and (b) mechanical wear of the steel hardware connecting the insulators to one another.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s). The parameters monitored or inspected should detect the presence and extent of aging effects.

The staff noted that surface contamination and mechanical wear are the potential aging effects of high-voltage insulators and a buildup of contamination could enable the conductor voltage to track along the surface and can lead to insulator flashover. The staff further noted that loss of material due to wear is a potential aging effect of strain and suspension insulators in that they are subject to movement. The staff determined that the parameters monitored or inspected of the evidence of salt deposit or mechanical wear of steel hardware connections will detect the aging effect of high-voltage insulators and will ensure the component-intended function during the period of extended operation.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects – LRA Section B.2.38 states that the high-voltage insulators within the scope of this program are to be inspected at least once every 4 years. The applicant stated that this is an adequate frequency to detect aging effects before a loss of component-intended function since experience has shown that aging degradation is a slow process. The applicant further stated a 4-year inspection interval will provide multiple data points during a 20-year period, which can be used to characterize the degradation rate, and the first inspection for license renewal is to be completed prior to the period of extended operation.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the parameters to be monitored or inspected should be appropriate to ensure that the SCs intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, and timing of inspection to ensure timely detection of aging effects. In addition, it states that the methods of technique and frequency may be linked to plant-specific or industry-wide operating experience.

The staff noted that the applicant did not identify the method or technique of inspection. The staff further noted that the method or technique should be identified and appropriate to ensure that high-voltage insulators will perform their intended functions for license renewal under all CLB design conditions. By letter dated November 3, 2009, the staff issued RAI B.2.38-1 requesting that the applicant identify the inspection technique for inspecting the high-voltage insulators.

In its response dated December 3, 2009, the applicant stated operating experience has shown that surface contamination on CR-3 high-voltage insulators is an applicable AERM. As a result of the flashover events at CR-3 due to salt spray, the applicant has applied a silicon coating to the insulators. The silicon coating is reapplied every 10 years. The applicant also stated that it will perform a visual inspection to verify that the silicon coating has not degraded as well as to assure there has been no accumulation of salt deposit or other airborne deposit, such as dust and industrial effluents, that could contaminate the insulator surface and lead to tracking. The applicant further stated that the silicon coating prevents the salt spray from adhering to the insulator under high wind, no rain environmental condition.

Based on its review, the staff finds the applicant's response to RAI B.2.38-1 acceptable because visual inspection is an acceptable method to inspect surface contamination on high-voltage insulators. The staff's concern described in RAI B.2.38-1 is resolved.

The staff noted on March 17, 1993, the applicant experienced a loss of the 230-kV switchyard (normal offsite power to safety-related buses) when a light rain caused arcing across salt-laden 230-kV insulators and opened breakers in the switchyard. On September 6, 2004, the applicant experienced phase-to-ground faults concurrently on a 230-kV transmission line and a 230-kV switchyard south bus breaker during Tropical Storm Frances. The staff noted the transmission line fault was caused by mechanical failure of a carbon steel pin in a vertical string of insulators due to high wind conditions, and the breaker fault was caused by flashover due to contamination from wind and salt spray. The applicant proposed a 4-year inspection interval and justified the 4-year inspection frequency based on a slow aging process. However, the staff noted that it did not link the proposed frequency of inspection to plant-specific operating experience. By letter dated November 3, 2009, the staff issued RAI B.2.38-3 requesting that the applicant provide additional technical justification of the proposed inspection frequency.

In its response dated December 3, 2009, the applicant stated that normally, rainwater will wash residual salt from the insulators. The applicant further stated that silicon coating prevents the salt spray from adhering to the insulator under high-wind, no-rain environmental conditions. Normally, the silicon coating has an expected life of greater than 10 years; therefore, a 4-year inspection frequency is sufficient to assure the coating remains intact. Based on its review, the staff finds the applicant's response to RAI B.2.38-3 acceptable because the silicon coating will prevent salt deposit on the surface of high-voltage insulators. Silicon coating has an expected life of greater than 10 years; therefore, a 4-year inspection frequency is adequate to detect degradation of insulator quality due to salt deposit. The staff's concern described in RAI B.2.38-3 is resolved.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending – LRA Section B.2.38 states that trending actions are not part of this program. However, the applicant stated that trending of discrepancies is performed (as required) in accordance with its corrective action program and the corrective action program is implemented by the CR-3 QA program in accordance with 10 CFR 50, Appendix B.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described and should provide predictability of the extent of degradation and thus affect timely corrective or mitigate actions. This program element describes how the data collected are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The staff determined that the absence of trending for testing is acceptable since this is an inspection, and the ability of trending is limited by the available data.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria – LRA Section B.2.38 states that inspection results are to be within the acceptance criteria to ensure component intended function(s) are maintained under all CLB design conditions during the period of extended operation. The applicant further stated that acceptance criteria will be delineated in the applicable inspection procedure.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.

The staff noted that the applicant did not describe the acceptance criteria and its basis. By letter dated November 3, 2009, the staff issued RAI B.2.38-2 requesting that the applicant describe the acceptance criteria against the need for corrective actions to ensure that the intended functions be maintained during the CLB.

In its response dated December 3, 2009, the applicant stated a visual inspection will be performed to verify that the silicon coating has not degraded as well as to assure that there has been no accumulation of salt deposit or other airborne deposits, such as dust and industrial effluent, that could contaminate the insulator surface and lead to cracking.

Based on its review, the staff finds the applicant's response to RAI B.2.38-2 acceptable because verifying that the silicon coating has not degraded as well as to assure there is no accumulation of salt deposit or other airborne deposit are acceptance criteria of visual inspection. The staff's concern described in RAI B.2.38-2 is resolved.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

(7) Operating Experience – LRA Section B.2.38 summarizes operating experience related to the High-Voltage Insulators in the 230-kV Switchyard Program. The applicant considered plant-specific and industry-wide operating experience in the development of all electrical programs in LRA Appendix B. The applicant stated that the review of

plant-specific and industry-wide operating experience ensures that this will be an effective AMP for the period of extended operation. The applicant has captured the plant-specific operating experience for high-voltage insulators by a review of one or more of the following: the action tracking database, system engineering notebooks and system health reports, and discussions with site engineering personnel. This effort may have also included a review of work management records, applicable site correspondence (licensee event reports, etc.), and Nuclear Assessment Section assessment records.

The following are plant-specific operating experiences applicable to this program:

> On March 17, 1993, the applicant experienced a loss of the 230-kV switchyard (i.e., a loss of offsite power) when a light rain caused arcing across salt-laden 230-kV insulators and opened switchyard breakers. This event was the subject of NRC Information Notice NRC 93-95, dated December 13, 1993: "Storm Crystal Related Loss of Offsite Power Events Due to Salt Buildup on Switchyard Insulators."
>
> On September 6, 2004, the applicant experienced phase-to-ground faults concurrently on a 230-kV transmission line and a 230-kV switchyard south bus breaker during Tropical Storm Frances. The transmission line fault was caused by mechanical failure of a carbon steel pin in a vertical string of insulators due to high wind conditions. The breaker fault was caused by flashover due to contamination from wind and salt spray.

Going forward, the applicant stated that it will capture operating experience through its corrective action and operating experience programs implemented in accordance with Progress Energy corporate procedures. This ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site. The applicant further stated that the administrative controls that implement the corrective action and operating experience programs are implemented in accordance with its QA Program, which is in conformance with 10 CFR 50, Appendix B. This process will verify that the electrical programs credited for license renewal will continue to be effective in the management of aging effects.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that operating experience with existing programs should be discussed. The operating experience should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation. An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The staff finds that although the High-Voltage Insulators in the 230-kV Switchyard Program is a new program with no operating experience for implementation, the applicant has captured component operating experience through reviewing onsite documentation. Going forward, the applicant will capture operating experience through its corrective action program and will consider industry and plant-specific operating experience when implementing the High-Voltage Insulators in the 230-kV Switchyard Program to confirm its effectiveness.

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

Based on its review of the application, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

FSAR Supplement. LRA Section A.1.1.38 provides the FSAR supplement for the High-Voltage Insulators in the 230-kV Switchyard Program. The staff reviewed this FSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff notes that the applicant committed (Commitment No. 28) to implement the new High-Voltage Insulators in the 230-kV Switchyard Program prior to entering the period of extended operation.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's High-Voltage Insulators in the 230-kV Switchyard Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), the applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation. SRP-LR, Branch Technical Position (BTP) RLSB-1, "Aging Management Review–Generic," describes 10 elements of an acceptable AMP. Elements (7), (8), and (9) are associated with the QA activities of "corrective actions," "confirmation process," and "administrative controls." BTP RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these program elements:

(1) Corrective Actions – Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(2) Confirmation Process – The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions are completed and effective.

(3) Administrative Controls – Administrative controls should provide for a formal review and approval process.

BTP IQMB-1, "Quality Assurance for Aging Management Programs," notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant may use the existing 10 CFR Part 50, Appendix B QA Program to address the elements of "corrective actions," "confirmation process," and "administrative controls." BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50, Appendix B requirements which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the period of extended operation.

- For nonsafety-related SCs that are subject to an AMR, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B Program to include these SCs to address "corrective actions," "confirmation process," and "administrative controls" for aging management during the period of extended operation. In this case, the applicant should document such commitment in the FSAR supplement, in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

In LRA Appendix A, "Final Safety Analysis Report Supplement," Section A.1.1, "Aging Management Programs and Activities," and Appendix B, "Aging Management Programs," Section B.1.3, "Quality Assurance Program and Administrative Controls," the applicant described the elements of "corrective actions," "confirmation process," and "administrative controls" that are applied to the AMPs for both safety-related and nonsafety-related components. The CR-3 QA Program is used which includes the elements of "corrective actions," "confirmation process," and "administrative controls." Corrective actions, confirmation process, and administrative controls are applied in accordance with the QA Program regardless of the safety classification of the components. LRA Sections A.1.1 and B.1.3 state that the QA Program implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and is consistent with the NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)," Revision 1.

3.0.4.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. The SRP-LR, BTP RLSB-1, "Aging Management Review-Generic," describes 10 attributes of an acceptable AMP. Three of these ten attributes are associated with the QA activities of corrective actions, confirmation process, and administrative controls. Table A.1-1, "Elements of an Aging Management Program for License Renewal," of BTP RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7 – Corrective Actions, including root cause determination and prevention of recurrence, should be timely.

- Attribute No. 8 – Confirmation Process, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

- Attribute No. 9 – Administrative Controls, which should provide a formal review and approval process.

The SRP-LR, BTP IQMB-1, "Quality Assurance for Aging Management Programs," states that those aspects of the AMP that affect quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing 10 CFR Part 50, Appendix B QA program may be used to address the elements of corrective action, confirmation process, and administrative control. BTP IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The staff reviewed the applicant's AMPs described in LRA Appendix A and Appendix B and the associated implementing procedures. The purpose of this review was to ensure that the QA attributes (corrective actions, confirmation process, and administrative controls) were consistent with the staff's guidance described in BTP IQMB-1. Based on the staff's evaluation, the descriptions of the AMPs and their associated quality attributes provided in LRA Appendix A, Section A.1.1 and Appendix B, Section B.1.3 are consistent with the staff's position regarding QA for aging management.

3.0.4.3 Conclusion

On the basis of the staff's evaluation, the descriptions and applicability of the plant-specific AMPs and their associated quality attributes provided in LRA Appendix A, Section A.1.1 and Appendix B, Section B.1.3 were determined to be consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective actions, confirmation process, and administrative controls) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.1 <u>Aging Management of Reactor Vessel Internals and Reactor Coolant System</u>

This section of the SER documents the staff's review of the applicant's AMR results for the reactor vessel, reactor vessel internals (RVI), and RCS components and component groups of:

- reactor coolant system

- control rod drive control system

- incore monitoring system

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, RVI, and RCS components and component groups. LRA Table 3.1.1, "Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor vessel, RVI, and RCS components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the reactor vessel, RVI, and RCS components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's review are documented in SER Section 3.1.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.1.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed, in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.1.2.3.

For SSCs which the applicant claimed are not applicable, or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.1-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.1 and addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel pressure vessel support skirt and attachment welds (3.1.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy RCPB piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.1)
Steel pump and valve closure bolting (3.1.1-4)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7,000 cycles) of thermal stress range	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.1)
Stainless steel and nickel-alloy RVI components (3.1.1-5)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)
Nickel -Alloy tubes and sleeves in a reactor coolant and secondary feedwater/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel RCPB closure bolting, head closure studs, support skirts and attachment welds, pressurizer relief tank components, steam generator components, piping and components external surfaces, and bolting (3.1.1-7)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)
Steel; stainless steel; and nickel-alloy RCPB piping, piping components, piping elements; flanges; nozzles and safe ends; pressurizer vessel shell heads and welds; heater sheaths and sleeves; penetrations; and thermal sleeves (3.1.1-8)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads, and welds (3.1.1-9)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy steam generator components (flanges; penetrations; nozzles; safe ends, lower heads, and welds) (3.1.1-10)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c), and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel top head enclosure (without cladding) top head nozzles (vent, top head spray, or reactor core isolation coolant (RCIC), and spare) exposed to reactor coolant (3.1.1-11)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2(1))
Steel steam generator shell assembly exposed to secondary feedwater and steam (3.1.1-12)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.1.2.2.2(1))
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-13)	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2(2))
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads, and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2(3))
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy RCPB components exposed to reactor coolant (3.1.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2(3))
Steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam (3.1.1-16)	Loss of material due to general, pitting, and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry, and for Westinghouse Model 44 and 51 S/G, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.2.2(4))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds (3.1.1-17)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with 10 CFR 50, Appendix G and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.3(1))
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-18)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes	Reactor Vessel Surveillance Program	Consistent with GALL Report (See SER Section 3.1.2.2.3(2))
Stainless steel and nickel-alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to SCC and intergranular stress-corrosion cracking (IGSCC)	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4(1))
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to SCC and IGSCC	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4(2))
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process (3.1.1-21)	Crack growth due to cyclic loading	TLAA	Yes	TLAA	Consistent with GALL Report (See SER Section 3.1.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy RVI components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	FSAR supplement commitment to: (1) participate in industry RVI aging programs, (2) implement applicable results, and (3) submit for staff approval, > 24 months before the period of extended operation, an RVI inspection plan based on industry recommendation.	No, but licensee commitment needs to be confirmed	Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.6)
Stainless steel reactor vessel closure head (RVCH) flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.1.2.2.7(1))
Class 1 CASS piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to SCC	Water Chemistry, and for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific AMP	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.2.7(2))
Stainless steel jet pump sensing line (3.1.1-25)	Cracking due to cyclic loading	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8(1))
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-26)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8(2))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy RVI screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	FSAR supplement commitment to: (1) participate in industry RVI aging programs, (2) implement applicable results, and (3) submit for staff approval, > 24 months before the period of extended operation, an RVI inspection plan based on industry recommendation.	No, but licensee commitment needs to be confirmed	Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.9)
Steel steam generator feedwater impingement plate and support exposed to secondary feedwater (3.1.1-28)	Loss of material due to erosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.2.10)
Stainless steel steam dryers exposed to reactor coolant (3.1.1-29)	Cracking due to flow-induced vibration	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.11)
Stainless steel RVI components (e.g., upper internals assembly, rod cluster control assembly (RCCA) guide tube assemblies, baffle and former assembly, lower internal assembly, shroud assemblies, plenum cover and plenum cylinder, upper grid assembly, control rod guide tube (CRGT) assembly, core support shield assembly, core barrel assembly, lower grid assembly, flow distributor assembly, thermal shield, and instrumentation support structures) (3.1.1-30)	Cracking due to SCC and irradiation-assisted stress-corrosion cracking (IASCC)	Water Chemistry and FSAR supplement commitment to: (1) participate in industry RVI aging programs, (2) implement applicable results, and (3) submit for staff approval > 24 months before the period of extended operation, an RVI inspection plan based on industry recommendation.	No, but licensee commitment needs to be confirmed	Water Chemistry Program and Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.12)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy and steel with nickel-alloy cladding piping, piping component, piping elements, penetrations, nozzles, safe ends, and welds (other than reactor vessel head); pressurizer heater sheaths, sleeves, diaphragm plate, manways, and flanges; core support pads and core guide lugs (3.1.1-31)	Cracking due to primary water stress-corrosion cracking (PWSCC)	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry, and FSAR supplement commitment to implement applicable plant commitments to: (1) NRC orders, bulletins, and generic letters associated with nickel-alloys, and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, and Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.13)
Steel steam generator feedwater inlet ring and supports (3.1.1-32)	Wall thinning due to flow-accelerated corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.2.14)
Stainless steel and nickel-alloy RVI components (3.1.1-33)	Changes in dimensions due to void swelling	FSAR supplement commitment to: (1) participate in industry RVI aging programs, (2) implement applicable results, and (3) submit for staff approval, > 24 months before the period of extended operation, an RVI inspection plan based on industry recommendation.	No, but licensee commitment needs to be confirmed	Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.15)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy reactor CRD head penetration pressure housings (3.1.1-34)	Cracking due to SCC and PWSCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry. For nickel-alloy, comply with applicable NRC orders and provide a commitment in the FSAR supplement to implement applicable: (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program	Consistent with Gall Report (See SER Section 3.1.2.2.16(1))
Steel with stainless steel or nickel-alloy cladding primary side components, steam generator upper and lower heads, tube sheets and tube-to-tube sheet welds (3.1.1-35)	Cracking due to SCC and PWSCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry. For nickel-alloy, comply with applicable NRC orders and provide a commitment in the FSAR supplement to implement applicable: (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, and Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.16(1))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy, stainless steel pressurizer spray head (3.1.1-36)	Cracking due to SCC and PWSCC	Water Chemistry and One-Time Inspection. For nickel-alloy welded spray heads, comply with applicable NRC orders and provide a commitment in the FSAR supplement to implement applicable: (1) bulletins and generic letters, and (2) staff-accepted industry guidelines.	No, but licensee commitment needs to be confirmed	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.2.16(2))
Stainless steel and nickel-alloy RVI components (e.g., upper internals assembly, RCCA guide tube assemblies, lower internal assembly, control element assembly (CEA) shroud assemblies, core shroud assembly, core support shield assembly, core barrel assembly, lower grid assembly, and flow distributor assembly) (3.1.1-37)	Cracking due to SCC, PWSCC, and IASCC	Water Chemistry and FSAR supplement commitment to: (1) participate in industry RVI aging programs, (2) implement applicable results, and (3) submit for staff approval, > 24 months before the period of extended operation, an RVI inspection plan based on industry recommendation.	No, but licensee commitment needs to be confirmed	Water Chemistry Program and Commitment	Consistent with GALL Report (See SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) CRD return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	Boiling Water Reactor (BWR) CRD Return Line Nozzle	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy penetrations for CRD stub tubes instrumentation, jet pump instrumentation, standby liquid control, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to SCC, IGSCC, and cyclic loading	BWR Penetrations and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy piping, piping components, and piping elements greater than or equal to 4-in nominal pipe size (NPS); nozzle safe ends and associated welds (3.1.1-41)	Cracking due to SCC and IGSCC	BWR SCC and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to SCC and IGSCC	BWR Vessel Inside Diameter (ID) Attachment Welds and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Stainless steel fuel supports and CRD assemblies; CRD housing exposed to reactor coolant (3.1.1-43)	Cracking due to SCC and IGSCC	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, CRD housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to SCC, IGSCC, and IASCC	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-45)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to SCC, IGSCC, and IASCC	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy RVIs exposed to reactor coolant (3.1.1-47)	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Steel and stainless steel Class 1 piping, fittings, and branch connections less than 4-in. NPS exposed to reactor coolant (3.1.1-48)	Cracking due to SCC, IGSCC (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and One-Time Inspection of the ASME Code Class 1 Small-Bore Piping	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
Nickel-alloy core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to SCC, IGSCC, and IASCC	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry. For BWRs with a crevice in the access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds.	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
High-strength, low alloy, steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to SCC and IGSCC	Reactor Head Closure Studs	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)
CASS jet pump assembly castings; orificed fuel support (3.1.1-51)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel RCPB pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems (3.1.1-52)	Cracking due to SCC, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to closed-cycle cooling water (3.1.1-53)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water (3.1.1-54)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
CASS Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant > 250 °C (>482 °F) (3.1.1-55)	Loss of fracture toughness due to thermal aging embrittlement	Inservice Inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, ISI requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report
Copper alloy > 15% zinc (Zn) piping, piping components, and piping elements exposed to closed-cycle cooling water (3.1.1-56)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
CASS Class 1 piping, piping component, and piping elements and CRD pressure housings exposed to reactor coolant >250 °C (> 482 °F) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Steel RCPB external surfaces exposed to air with borated water leakage (3.1.1-58)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, auxiliary feedwater (AFW) nozzles and safe ends exposed to secondary feedwater or steam (3.1.1-59)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Stainless steel flux thimble tubes (with or without chrome plating) (3.1.1-60)	Loss of material due to wear	Flux Thimble Tube Inspection	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Stainless steel, steel pressurizer integral support exposed to air with metal temperature up to 288 °C (550 °F) (3.1.1-61)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report
Stainless steel, steel with stainless steel cladding RCS cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-62)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report
Steel reactor vessel flange, stainless steel and nickel-alloy RVIs exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, core support shield assembly, lower grid assembly) (3.1.1-63)	Loss of material due to wear	Inservice Inspection (IWB, IWC, and IWD)	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and steel with stainless steel or nickel-alloy cladding pressurizer components (3.1.1-64)	Cracking due to SCC and PWSCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program	Consistent with GALL Report
Nickel-alloy reactor vessel upper head and CRD penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to PWSCC	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and Nickel-Alloy Penetration Nozzles Welded to the Upper RVCHs of PWRs	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program	Consistent with GALL Report
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-66)	Loss of material due to erosion	Inservice Inspection (IWB, IWC, and IWD) for Class 2 components	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report
Steel with stainless steel or nickel-alloy cladding; or stainless steel pressurizer components exposed to reactor coolant (3.1.1-67)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel with stainless steel cladding Class 1 piping, fittings, pump casings, valve bodies, nozzles, safe ends, manways, flanges, CRD housing; pressurizer heater sheaths, sleeves, diaphragm plate; pressurizer relief tank components, RCS cold leg, hot leg, surge line, and spray line piping and fittings (3.1.1-68)	Cracking due to SCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program	Consistent with GALL Report
Stainless steel, nickel-alloy safety injection nozzles, safe ends, and associated welds and buttering exposed to reactor coolant (3.1.1-69)	Cracking due to SCC and PWSCC	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, and Commitment	Consistent with GALL Report (See SER Section 3.1.2.1.2)
Stainless steel; steel with stainless steel cladding Class 1 piping, fittings, and branch connections less than 4-in. NPS exposed to reactor coolant (3.1.1-70)	Cracking due to SCC, thermal, and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and One-Time Inspection of the ASME Code Class 1 Small-Bore Piping	No	ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program	Consistent with GALL Report (See SER Section 3.1.2.1.3)
High-strength, low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to SCC; loss of material due to wear	Reactor Head Closure Studs	No	Reactor Head Closure Studs Program	Consistent with GALL Report
Nickel-alloy steam generator tubes and sleeves exposed to secondary feedwater/steam (3.1.1-72)	Cracking due to outside diameter (OD) SCC and intergranular attack, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Program and Water Chemistry Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to PWSCC	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Program and Water Chemistry Program	Consistent with GALL Report
Chrome plated steel, stainless steel, nickel-alloy steam generator anti-vibration bars exposed to secondary feedwater or steam (3.1.1-74)	Cracking due to SCC, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Nickel-alloy OTSG tubes exposed to secondary feedwater or steam (3.1.1-75)	Denting due to corrosion of carbon steel tube support plate	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Program and Water Chemistry Program	Consistent with GALL Report
Steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam (3.1.1-76)	Loss of material due to erosion, general, pitting, and crevice corrosion; ligament cracking due to corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity Program and Water Chemistry Program	Consistent with GALL Report
Nickel-alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater/steam (3.1.1-77)	Loss of material due to wastage and pitting corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater/steam (3.1.1-78)	Wall thinning due to flow-accelerated corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy steam generator tubes exposed to secondary feedwater or steam (3.1.1-79)	Denting due to corrosion of steel tube support plate	Steam Generator Tube Integrity and Water Chemistry. For plants that could experience denting at the upper support plates, evaluate potential for rapidly propagating cracks, and then develop and take corrective actions consistent with NRC Bulletin 88-02.	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
CASS RVI (e.g., upper internals assembly, lower internal assembly, CEA shroud assemblies, CRGT assembly, core support shield assembly, lower grid assembly) (3.1.1-80)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Thermal Aging and Neutron Irradiation Embrittlement of CASS Program	Consistent with GALL Report
Nickel-alloy or nickel-alloy clad steam generator divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to primary water SCC	Water Chemistry	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy RVIs and RCPB components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater/steam (3.1.1-84)	Cracking due to SCC	Water Chemistry and One-Time Inspection or Inservice Inspection (IWB, IWC, and IWD)	No	Water Chemistry Program and One-Time Inspection Program or ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with GALL Report
Nickel-alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (external) (3.1.1-85)	None	None	NA	None	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to air-indoor uncontrolled (external); air with borated water leakage; concrete; gas (3.1.1-86)	None	None	NA	None	Consistent with GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	NA	Not applicable	Not applicable to CR-3 (See SER Section 3.1.2.1.1)

The staff's review of the reactor vessel, RVI, and RCS component groups followed any one of several approaches. One approach, documented in SER Section 3.1.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.1.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.1.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the reactor vessel, RVI, and RCS components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.1.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the reactor vessel, RVI, and RCS components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program

- Boric Acid Corrosion Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Lubricating Oil Analysis Program
- Nickel-Alloy Commitment
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program
- One-Time Inspection Program
- Reactor Head Closure Studs Program
- Reactor Vessel Internals Commitment
- Reactor Vessel Surveillance Program
- Selective Leaching of Materials Program
- Steam Generator Tube Integrity Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Water Chemistry Program

LRA Tables 3.1.2-1 through 3.1.2-3 summarize AMRs for the reactor vessel, RVI, and RCS components and indicate AMRs claimed to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMR's that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the RVI and RCS systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. The staff's evaluation follows.

LRA Table 3.1.1, item 3.1.1-68, addresses stainless steel or steel with stainless steel cladding Class 1 components exposed to reactor coolant which are being managed for cracking due to SCC. The LRA credits the Water Chemistry Program and the ASME Section XI Inservice

Inspection, Subsections IWB, IWC, and IWD Program to manage the aging effect. The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed. The AMR line items cite generic notes A and C, indicating that the line item is consistent with the GALL Report item for component, material, environment, and aging effect and the LRA AMP is consistent with the GALL Report AMP, and the component is different, but consistent with the GALL Report item for material, environment, and aging effect and the LRA AMP is consistent with GALL Report AMP, respectively.

The staff reviewed the LRA AMR items associated with item 3.1.1-68. The applicant credited GALL Report items IV.C2-2, IV.C2-5, IV.C2-20, and IV.C2-27, in LRA Tables 3.1.2-1, 3.2.2-2, 3.2.2-3, and 3.3.2-42, for SCC of stainless steel or steel with stainless steel cladding Class 1 components. The GALL Report recommends the use of GALL AMP XI.M1 and GALL AMP XI.M2. During its review, the staff noted that a similar aging mechanism that affects these same components is cracking due to cyclic loading. In the LRA, there are a few stainless steel or steel with stainless steel cladding components exposed to a reactor coolant environment that the applicant did not indicate were susceptible to cracking from cyclic loading. By letter dated December 1, 2009, the staff issued RAI 3.2.2.1-1 requesting that the applicant clarify why these components are not considered to be affected by cracking due to cyclic loading.

In its response dated December 30, 2009, the applicant stated that this aging effect has been added to the identified components and that the affected components will be aligned to GALL Report item IV.C2-26 or IV.C2-18. The applicant stated that those components aligned with item IV.C2-26 will be managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, and those components aligned with item IV.C2-18 will be managed by the Water Chemistry and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD programs. The GALL Report recommends the Water Chemistry and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD programs for item IV.C2-18. The GALL Report further recommends the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for item IV.C2-26.

Based on its review, the staff finds the applicant's response to RAI 3.2.2.1-1 acceptable because the applicant's proposal to address cracking from cyclic loading in stainless steel or steel with stainless steel cladding Class 1 components is consistent with the recommendations in GALL Report items IV.C2-18 and IV.C2-26. The staff's concern described in RAI 3.2.2.1-1 is resolved.

3.1.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.1.1, items 3.1.1-38 through 3.1.1-51, discuss the applicant's determination that these line items are applicable only to BWRs. The staff verified that these line items do not apply because CR-3 is a PWR design. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR items 3.1.1-38 through 3.1.1-51 are not applicable.

LRA Table 3.1.1, item 3.1.1-53, addresses loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this line item is not applicable. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that the applicant's LRA does not have any AMR results for the reactor vessel, RVIs, and RCS that include steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope steel piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the reactor vessel, RVIs, and RCS and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-54, addresses loss of material due to pitting, crevice, and galvanic corrosion in copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this line item is not applicable. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that the applicant's LRA does not have any AMR results for the reactor vessel, RVIs, and RCS that include copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the reactor vessel, RVIs, and RCS and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-56, addresses copper alloy with greater than 15 percent zinc piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this line item is not applicable. The staff reviewed LRA Sections 2.3.1 and 3.1 and confirmed that the applicant's LRA does not have any AMR results for the reactor vessel, RVIs, and RCS that include copper alloy with greater than 15 percent zinc piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's FSAR did not find any evidence of copper alloy with greater than 15 percent zinc piping, piping components, and piping elements in these systems exposed to closed-cycle cooling water. Based on its review of the LRA and FSAR, the staff confirmed that there are no in-scope copper alloy with greater than 15 percent zinc piping, piping components, and piping elements exposed to closed-cycle cooling water in the reactor vessel, RVIs, and RCS and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-57, addresses CASS Class 1 piping, piping components, piping elements, and control rod drive (CRD) pressure housings exposed to reactor coolant greater than 250 °C (482 °F). The GALL Report recommends the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program to manage loss of fracture toughness due to thermal aging embrittlement for this component group. The applicant stated that this item is not applicable. In addition, the applicant indicated that valve bodies and pump casings are adequately covered by existing inspection requirements in ASME Code Section XI. The staff evaluated the applicant's claim by reviewing the FSAR, which indicated that the only CASS components are the reactor coolant pump (RCP) casings and snuff box and reactor coolant valves. A review of the letter from C.I. Grimes (NRC) to D. Walters (NEI) entitled, "License renewal issue No. 98-0030, 'Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Components,'" indicated that CASS valve bodies and pump casings are adequately inspected by the existing requirements in ASME Code Section XI for loss of fracture toughness. The staff confirmed in LRA Table 3.1.2-1 that the CASS RCP casings and covers and Class 1 valve bodies are managed by the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. By review of these documents, the staff found the applicant's determination acceptable because the only CASS components in the RCS are pump casings and valve bodies, which the applicant is managing with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program.

LRA Table 3.1.1, item 3.1.1-59, addresses wall thinning due to flow-accelerated corrosion in steel nozzles and safe ends for the steam, feedwater, and auxiliary feedwater nozzles on the steam generator that are exposed to secondary feedwater and steam. The applicant stated that this line item is not applicable. The staff reviewed the applicant's FSAR, Table 4-4, "Steam

Generator Design Data,” which indicates that the secondary side steam generator nozzles for the steam, main feedwater, and emergency feedwater are constructed of carbon steel. As such, it was unclear why the applicant claimed this item was not applicable. By letter dated December 1, 2009, the staff issued RAI 3.1.2.1-5 requesting that the applicant provide additional information regarding its basis for claiming this item is not applicable.

In its response dated December 30, 2009, the applicant stated that, as indicated in the definition section for aging mechanisms in the GALL Report, the susceptibility to flow-accelerated corrosion may be determined using guidance in NSAC-202L, “Recommendations for an Effective Flow-Accelerated Corrosion Program.” The applicant’s response described the configurations of the headers and attachments to the steam generator for the main feedwater and auxiliary feedwater systems, and noted that these configurations were not the standard nozzle and safe end as described in the GALL Report. The applicant stated that a plant-specific susceptibility evaluation had been performed for the main feedwater and auxiliary feedwater attachments, which had determined that these components were not susceptible to flow-accelerated corrosion. The applicant also stated that the steam outlet nozzles are exposed to superheated steam, which NSAC-202L indicates can be excluded from the scope of the flow-accelerated corrosion program. The applicant provided a table regarding changes to various component materials for the recently-replaced steam generators, which indicated the headers, risers, and nozzles in the main feedwater and auxiliary feedwater had been changed to a low alloy steel material. The staff finds this response acceptable because, although the LRA indicated that flow-accelerated corrosion was not applicable to this component group, the applicant had performed a susceptibility evaluation as provided by NSAC-202L and determined that the associated components were not susceptible to flow-accelerated corrosion. In addition, the staff notes that the recent change in material, which contains chromium and molybdenum for the associated components in the replacement steam generators, increased the resistance of these components to flow-accelerated corrosion. The staff’s concern described in RAI 3.1.2.1-5 is resolved. Based on the staff’s review of the LRA and the applicant’s response to RAI 3.1.2.1-5, the staff finds the applicant’s determination acceptable.

LRA Table 3.1.1, item 3.1.1-60, addresses stainless steel flux thimble tubes (with or without chrome plating) exposed to reactor coolant. The GALL Report recommends GALL AMP XI.M37, “Flux Thimble Tube Inspection,” to manage loss of material due to wear for this component. The applicant stated that this item is not applicable. The staff reviewed GALL AMP XI.M37 and noted that this program is based on licensee responses to NRC Bulletin No. 88-09, “Thimble Tube Thinning In Westinghouse Reactors.” The staff noted that the concerns described in NRC Bulletin No. 88-09 are associated with PWRs that are of Westinghouse design. The plant is a PWR of Babcock & Wilcox design; therefore, the staff finds the applicant’s determination acceptable.

LRA Table 3.1.1, item 3.1.1-74, addresses chrome plated steel, stainless steel, and nickel-alloy steam generator anti-vibration bars exposed to secondary feedwater or steam subject to cracking due to SCC, loss of material due to crevice corrosion, and fretting for this component group. The applicant stated that this item is not applicable because this component, material, environment, and aging effect combination does not apply to its steam generators. The staff noted that LRA Table 3.1.1, item 3.1.1-74, is associated with GALL AMR items IV.D1-14 and IV.D1-15, which are specific to recirculating steam generators. The staff reviewed the applicant’s FSAR and confirmed that the applicant’s steam generators are OTSGs without anti-vibration bars and, therefore, finds the applicant’s determination acceptable.

LRA Table 3.1.1, item 3.1.1-77, addresses nickel-alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater or steam subject to loss of material due to wastage and pitting corrosion for this component group. The applicant stated that this item is not applicable because it does not use phosphate chemistry. The staff reviewed EPRI TR-1008224, "Pressurized Water Reactor Secondary Water Chemistry Guidelines – Revision 6," which is incorporated into the applicant's Water Chemistry Program and noted that it recommends not using phosphates as an inhibitor because of the intergranular attack/stress corrosion cracking (IGA/SCC) and wastage associated problems. The staff confirmed that the applicant does not use phosphate chemistry and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-78, addresses steel steam generator tube support lattice bars exposed to secondary feedwater or steam subject to wall thinning due to flow-accelerated corrosion for this component group. The applicant stated that this item is not applicable because its steam generators do not have lattice bars. The staff noted that LRA Table 3.1.1, item 3.1.1-78, is associated with GALL AMR item IV.D1-16, which is only applicable to recirculating steam generators. The staff reviewed the applicant's FSAR and confirmed that the applicant's steam generators are OTSGs without lattice bars and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1.-79, addresses nickel-alloy steam generator tubes exposed to secondary feedwater or steam subject to denting at the upper support plates for this component group. The applicant stated that this item is not applicable because this component, material, environment, and aging effect or mechanism combination does not apply to its steam generator tubes. The staff reviewed LRA Sections 2.3.1 and 3.1 and the applicant's FSAR, and confirmed that the applicant's steam generators are OTSGs for which the same aging effect of denting due to corrosion of steel tube support plate is addressed by LRA Table 3.1.1, item 3.1.1-75, whereas item 3.1.1-79 is applicable to recirculating steam generators; therefore, the staff finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-81, addresses nickel-alloy or nickel-alloy clad steam generator divider plate exposed to reactor coolant subject to cracking due to PWSCC for this component group. The applicant stated that this item is not applicable because this component, material, environment, and aging effect or mechanism combination does not apply to its steam generators. The staff noted that LRA Table 3.1.1, item 3.1.1-81, is associated with GALL AMR item IV.D1-6, which is only applicable to recirculating steam generators. The staff reviewed the applicant's FSAR and confirmed that the applicant's steam generators are OTSGs without a divider plate and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-82, addresses stainless steel steam generator primary side divider plate exposed to reactor coolant subject to cracking due to SCC for this component group. The applicant stated that this item is not applicable because this component, material, environment, and aging effect or mechanism combination does not apply to its steam generators. The staff noted that LRA Table 3.1.1, item 3.1.1-82, is associated with GALL AMR item IV.D1-7, which is only applicable to recirculating steam generators. The staff reviewed the applicant's FSAR and confirmed that the applicant's steam generators are OTSGs without a divider plate and, therefore, finds the applicant's determination acceptable.

LRA Table 3.1.1, item 3.1.1-87, addresses steel piping, piping components, and piping elements in concrete. The GALL Report states that there is no AERM. The applicant stated that this line item is not applicable because it has no components within the scope of license renewal in concrete in the reactor vessel, RVIs, and RCS, so the applicable GALL Report line was not used. The staff reviewed the applicant's FSAR and confirmed that no in-scope steel piping, piping components, and piping elements in concrete are present in these systems and, therefore, finds the applicant's determination acceptable.

3.1.2.1.2 Cracking Due to Stress-Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-69, addresses nickel-alloy reactor vessel core flood nozzle weld exposed to reactor coolant which is being managed for SCC. The LRA credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, and Nickel Alloy Commitment to manage the aging effect. The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed. The associated AMR line item cites generic note E.

For those AMRs associated with generic note E, GALL AMP XI.M1 recommends using NDEs, and GALL AMP XI.M2 recommends water chemistry controls to manage the aging of these line items. In its review of components associated with LRA Table 3.1.1, item 3.1.1-69, for which the applicant cited generic note E, the staff noted that the applicant-proposed programs are consistent with the recommendations of the GALL Report and, in addition, the applicant has committed (Commitment No. 2) to the following:

> In accordance with the guidance of NUREG-1801, regarding activities for managing the aging of nickel alloy and nickel-clad components susceptible to primary water stress corrosion cracking, CR-3 will comply with applicable NRC Orders and will implement: (1) applicable Bulletins and Generic letters, and (2) staff-accepted industry guidelines.

During the staff's onsite audit, the staff noted that the applicant's Commitment No. 2 discussed above did not define a timeframe for an implementation of the committed actions. Therefore, by letter dated September 11, 2009, the staff issued RAI B.2.4-2 requesting that the applicant clarify its implementation schedule.

By letter dated November 13, 2009, the applicant responded to RAI B.2.4.2-2 stating that CR-3 will be consistent with the guidance in the GALL Report. The staff finds the applicant's response to RAI B.2.4.2-2 acceptable because the applicant's proposed aging management is consistent with the recommendations in the GALL Report.

The staff's evaluations of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.2, respectively. The staff noted that the Water Chemistry Program monitors and controls the concentration of contaminants in the water in order to minimize corrosion and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will perform inspections to verify the effectiveness of the Water Chemistry Program. The staff noted that the activities associated with Commitment No. 2 are beyond the recommendations of the GALL Report, and these activities are conservative for managing PWSCC in these nickel-alloy components. The staff finds the applicant's Nickel Alloy Commitment acceptable because the activities implemented as part of this commitment provide additional assurance that PWSCC will be adequately managed during the period of extended operation.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.1.3 Cracking Due to Stress-Corrosion Cracking for Stainless Steel Exposed in Reactor Coolant (Internal)

LRA Table 3.1.2-1, item 3.1.1-70, addresses Class 1 piping, fittings, and branch connections with NPS of less than 4 inches which are being managed for SCC and cracking due to thermal and mechanical loading. The LRA credits the ASME Section XI Inservice Inspection and Water Chemistry programs to manage the aging effects. The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection," and for PWR primary water, GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.M35, "One Time Inspection of ASME Code Class 1 Small Bore Piping," to ensure that these aging effects are adequately managed. The associated AMR line item cites generic note E, indicating that the LRA AMR is consistent with GALL Report item for material, environment, and aging effect, but a different AMP is credited.

For those line items associated with generic note E, GALL AMP XI.M1 recommends using NDEs, GALL AMP XI.M2 recommends water chemistry controls to manage the aging of these line items, and GALL AMP XI.M35 recommends a one-time inspection consisting of a volumetric examination in small bore piping to detect cracking due to SCC and cracking due to thermal and mechanical loading. In its review of components associated with LRA Table 3.1.2-1, item 3.1.1-70 for which the applicant cited generic note E, the staff noted that the same AMPs were proposed as recommended by the GALL Report except that the applicant's ASME Section XI Inservice Inspection Program incorporated elements of GALL AMP XI.M35. By letters dated March 3, 2010, and August 9, 2010, the applicant provided supplemental information to address the issue of small bore piping inspection. Based on the applicant's plant-specific operating experience, it has revised the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to include periodic volumetric examinations of Class 1 small bore piping. The staff noted that the difference between the applicant's proposed aging management and the recommendations in the GALL Report is that the applicant will perform a periodic inspection in lieu of a one-time inspection. The staff finds the applicant's proposal to perform periodic inspections on Class 1 small-bore piping acceptable because it is more conservative than the one-time inspection recommended in the GALL Report.

The staff's evaluations of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.2, respectively. The staff finds the applicant's use of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs acceptable because the Water Chemistry Program monitors and controls the concentration of contaminants in the water in order to minimize corrosion and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will perform periodic inspections to detect cracking due to SCC and cracking due to thermal and mechanical loading in small bore piping, and to verify the effectiveness of the Water Chemistry Program.

3.1.2.1.4 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.1.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.1.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the reactor vessel, RVIs, and RCS components and provided information concerning how it will manage the following aging effects:

- change in dimensions
- cracking
- cumulative fatigue damage
- denting
- ligament cracking
- loss of fracture toughness
- loss of material
- loss of preload
- reduction of heat transfer effectiveness

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.1.2.2. The staff's review of the applicant's further evaluation follows.

3.1.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.1.2.2.1, the applicant stated that fatigue is a TLAA that must be evaluated in accordance with 10 CFR 54.21(c)(1) and that its TLAA evaluations are addressed in LRA Section 4.3.

In LRA Table 3.1.1, the applicant identified items 3.1.1-1 and 3.1.1-5 through 3.1.1-10 as TLAA items for the reactor vessel, RVI, and RCS. The applicant performed cumulative fatigue evaluations for these components. SER Section 4.3 documents the staff's review of the applicant's evaluation of TLAA for these components.

The applicant stated in LRA Table 3.1.1 that items 3.1.1-2 through 3.1.1-4 are applicable to BWRs only. The staff noted that the applicant's plant is a PWR design, therefore, items 3.1.1-2 through 3.1.1-4 are not applicable.

The staff noted that LRA Table 3.1.2-1 addresses the steam generator tubesheets aging effects for reactor coolant and air-indoor uncontrolled. However, the applicant does not address the aging effect for the surface of the low alloy steel steam generator tubesheets in the environment of secondary feedwater/steam. The staff further noted that for similar component/environment combinations (such as GALL Report item IV.D2-8) the GALL Report identifies an aging effect of concern of loss of material due to general, pitting, and crevice corrosion.

By letter dated December 1, 2009, the staff issued RAI 3.1.2.1-4 requesting that the applicant clarify why this aging effect for the steam generator tubesheets is not of concern at CR-3.

In its response dated December 30, 2009, the applicant stated an evaluation of the tubesheets exposed to treated water has been performed and resulted in cumulative fatigue damage due to fatigue being an AERM. The staff noted that the applicant amended its LRA by letter dated December 30, 2009, such that the low alloy steel steam generator tubesheets exposed to treated water (inside) is subject to cumulative fatigue damage and is a TLAA which references LRA Table 3.1.1, item 3.1.1-10. The staff reviewed LRA Section 4.3 and confirmed that the applicant identified the applicable TLAA for this component and the cumulative usage factor for this component is below the ASME Code design limit of 1.0. The applicant also included the aging effect of loss of material due to general, crevice, and pitting corrosion that will be managed by a combination of the Water Chemistry and One-Time Inspection programs. The staff's evaluation of this portion of the applicant's response to RAI 3.1.2.1-4 is documented in SER Section 3.1.2.2.2(1).

Based on its review, the staff finds the applicant's response to RAI 3.1.2.1-4 acceptable because the applicant amended its LRA to include the applicable aging effect of cumulative fatigue damage due to fatigue, the staff confirmed that the applicant included the TLAA for this component in its LRA, the cumulative usage factor for this component is below the ASME Code design limit of 1.0 and the applicant's AMR is consistent with GALL Report item IV.D2-3. SER Section 4.3 documents the staff's review of the applicant's evaluation of TLAA for these components. The staff's concern described in RAI 3.1.2.1-4 is resolved.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.

(1) The staff noted that LRA Table 3.1.1, item 3.1.1-11, which states the item is applicable only to BWRs, corresponds to SRP-LR Table 3.1-1, item 11 which references SRP-LR Section 3.1.2.2.2, item 1 and is applicable to BWRs only and is, therefore, not applicable to CR-3 which is a PWR design.

LRA Table 3.1.1, item 3.1.1-12, refers to LRA Section 3.1.2.2.2.1 which addresses the steel steam generator shell assembly exposed to secondary feedwater and steam which is being managed for loss of material due to general, pitting, and crevice corrosion by the Water Chemistry and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam and for the steel top head enclosure top head nozzles exposed to reactor coolant. The applicant further stated that it will manage the loss of material due to general, pitting, and crevice corrosion in the steel components exposed to secondary feedwater/steam and reactor coolant in the steam generator with the Water Chemistry and the One-Time Inspection programs for susceptible locations to verify the effectiveness of the Water Chemistry Program in managing the loss of material due to general, pitting, and crevice corrosion.

The staff reviewed LRA Section 3.1.2.2.2, item 1 against the criteria in SRP-LR Section 3.1.2.2.2, item 1, which states that loss of material due to general, pitting, and crevice corrosion could occur for the steel PWR steam generator shell assembly exposed to secondary feedwater and steam and for the steel top head enclosure exposed to reactor coolant. The SRP-LR also states that the existing program relies on control of reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program.

The LRA proposes to extend the aging management of loss of material due to general, pitting, and crevice corrosion in the steel PWR steam generator shell assembly to other components of the steam generators, in relation with the material, the environment, and the aging effect, such as the tube support plate assembly (tube support plate, rods, nuts, etc.), the steam generator main feedwater spray nozzle flanges, the steam generator baffle assemblies, the steam outlet nozzle, the steam generator auxiliary feedwater nozzle thermal sleeves, the steam generator secondary side nozzles, and the steam generator secondary manway and handhole opening covers.

The staff noted that LRA Table 3.1.2-1 contains additional components other than the shell assembly referenced by LRA Table 3.1.1, item 3.1.1-12, and that the applicant considers these items consistent with the GALL Report. It was not clear to the staff how the One-Time Inspection Program will be implemented for components other than the shell assembly recommended in the GALL Report and how it will be able to adequately detect the aging effect, especially inside the tube bundle in the case of the tube support plate assembly.

By letter dated December 1, 2009, the staff issued RAI 3.1.2.2.2.1-1 requesting that the applicant explain how the One-Time Inspection Program will be implemented (NDE techniques, sample, etc.) for steam generator components whose access appears more difficult than for the shell assembly in order to verify the effectiveness of the Water Chemistry Program and the absence of the aging effect of concern.

In its response dated December 30, 2009, the applicant stated that all components that are managed by the One-Time Inspection Program become part of the sample and the inspection includes a representative sample of the population, and where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. The applicant further stated that the steam generators were replaced in the fall 2009 outage and since one-time inspections are to be completed prior to the end of the current license term (i.e., December 3, 2016), using these locations as part of the sample would not provide the required information on the effectiveness of the Water Chemistry Program. The applicant further stated that components that are upstream of the steam generators would be preferentially inspected because they would meet the GALL Report recommendations to focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. The staff noted that components from the recently-replaced steam generators do not meet the recommendation of GALL AMP XI.M32, which states that the sample of components should include the most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.2.2.1-1 acceptable because the applicant's inspections, as part of the One-Time Inspection Program, will focus the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin which are upstream of the steam generators that have been in service for a significant amount of time to demonstrate the effectiveness of the Water Chemistry Program. The staff's concern described in RAI 3.1.2.2.2.1-1 is resolved.

The staff noted that LRA Table 3.1.2-1 addresses the steam generator tubesheets aging effects for reactor coolant and uncontrolled indoor air. However, the applicant does not address the aging effect for the surface of the low alloy steel steam generator tubesheets in the environment of secondary feedwater/steam. The staff further noted that for similar component/environment combinations (such as GALL Report item IV.D2-8) the GALL Report identifies an aging effect of concern of loss of material due to general, pitting, and crevice corrosion.

By letter dated December 1, 2009, the staff issued RAI 3.1.2.1-4 requesting that the applicant clarify why this aging effect for the steam generator tubesheets is not of concern at CR-3.

In its response dated December 30, 2009, the applicant stated an evaluation of the tubesheets exposed to treated water has been performed and resulted in loss of material due to general, crevice, and pitting corrosion being an AERM. The applicant also stated that this aging effect will be managed by a combination of the Water Chemistry and One-Time Inspection programs. The staff noted that the applicant amended its LRA by letter dated December 30, 2009, such that the low alloy steel steam generator tubesheets exposed to treated water (inside) is subject to loss of material due to general, crevice, and pitting corrosion reference LRA Table 3.1.1, item 3.1.1-12. The applicant also included the aging effect of cumulative fatigue damage as a TLAA, which references LRA Table 3.1.1, item 3.1.1-10. The staff's evaluation of this portion of the applicant's response to RAI 3.1.2.1-4 is documented in SER Section 3.1.2.2.1.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.1-4 acceptable because the applicant amended its LRA to include the applicable aging effect of loss of material due to general, pitting, and crevice corrosion and the applicant's use of the Water Chemistry and One-Time Inspection programs is consistent with the recommendations of the GALL Report, SRP-LR Section 3.1.2.2.2, item 1, and GALL Report item IV.D2-8. The staff's concern described in RAI 3.1.2.1-4 is resolved.

The staff's evaluations of the applicant's Water Chemistry Program and the One-Time Inspection Program are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff determined that the Water Chemistry Program includes activities to mitigate aging effects on component surfaces by controlling water chemistry for impurities such as dissolved oxygen, chlorides, fluorides, and sulfates that can potentially accelerate corrosion and cracking. The staff further determined that this program relies on monitoring and control of water chemistry in order to keep the peak levels of various impurities below the specified limits. Furthermore, the applicant may add chemical agents, such as corrosion inhibitors, oxygen scavengers, and biocides, to prevent certain aging mechanisms. The staff noted that the applicant's program is based on the latest revision of the EPRI guidelines and will continue to update the program as new revisions of this guideline are released. The staff determined that the applicant's One-Time Inspection Program will verify the effectiveness of its Water Chemistry Program. In its review of components associated with item 3.1.1-12, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and the One-Time Inspection Program acceptable because impurities that can promote corrosion and cracking will be maintained and controlled for these components by the Water Chemistry Program and will be supplemented by the One-Time Inspection Program to confirm the effectiveness of the chemistry program, consistent with the recommendations in the GALL Report.

(2) LRA Section 3.1.2.2.2.2 states that the aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.2, item 2 states that loss of material due to pitting and crevice corrosion may occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting, and crevice corrosion may occur in steel BWR isolation condenser components. The staff finds that SRP-LR Section 3.1.2.2.2, item 2 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs with an isolation condenser.

(3) LRA Section 3.1.2.2.2.3 states that the aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.2, item 3 states that loss of material due to pitting and crevice corrosion may occur in stainless steel, nickel-alloy, and steel with stainless steel or nickel-alloy cladding flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads, and welds exposed to reactor coolant. This section of the SRP-LR is cross-referenced to the GALL Report, Table IV.C1 which is for BWRs. The staff finds that SRP-LR Section 3.1.2.2.2, item 3 is not applicable because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(4) LRA Section 3.1.2.2.2.4 addresses steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The GALL Report recommends use of GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," GALL AMP XI.M2, "Water Chemistry," and for Westinghouse Model 44 and 51 S/G, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because this component, material, environment, and aging effect/mechanism combination does not apply to the reactor vessel, RVIs, and RCS. The staff reviewed GALL AMR item IV.D1-12, which is associated with LRA Table 3.1.1, item 3.1.1-16, and noted the recommendations for aging management are specific to the steel steam generator upper and lower shell and transition cone for recirculating steam generators. The staff reviewed FSAR Section 4.2.1.1 and FSAR Figures 4-1 and 4-5 and confirmed that the applicant uses OTSGs and, therefore, finds the applicant's determination acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria. For those line items that apply to LRA Section 3.1.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the criteria in SRP-LR Section 3.1.2.2.3.

(1) LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

(2) LRA Section 3.1.2.2.3.2 addresses loss of fracture toughness due to neutron irradiation embrittlement. The applicant stated that participation in the master integrated reactor vessel surveillance program (MIRVP), as described in LRA Section B.2.17, manages this aging effect in low alloy steel components clad with stainless steel exposed to reactor coolant.

SRP-LR Section 3.1.2.2.3, item 2 states that the loss of fracture toughness due to neutron irradiation embrittlement may occur in BWR and PWR reactor vessel beltline plates, forgings, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on factors such as the composition of limiting materials, availability of surveillance capsules, and projected neutron fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in GALL Report Chapter XI, Section M31.

The applicant's Reactor Vessel Surveillance Program is documented in LRA Section B.2.17 and Section 4.2. The GALL AMP XI.M31 "detection of aging effects" program element states that, "all pulled and tested capsules, unless discarded before August 31, 2000, are placed in storage." Some MIRVP tested specimens were not retained for future reconstitution use. However, sets of specimens from CR-3 beltline weld heats are permanently archived at the Point Beach Nuclear Plant. The applicant committed (Commitment No. 12) to implementing the following enhancements prior to the period of extended operation:

- Program Element 1: Enhance the program to ensure that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year period of extended license operation.

- Program Element 4: Establish formalized controls for the storage of archived specimens to ensure availability for future use by maintaining the identity, traceability, and recovery of the archived specimens throughout the period of storage.

- Program Element 6: Refer to the enhancement for projecting the effects of embrittlement discussed under Program Element 1 above.

- Program Element 7: Refer to the enhancement for projecting the effects of embrittlement discussed under Program Element 1 above.

- Program Element 8: Refer to the enhancement for projecting the effects of embrittlement discussed under Program Element 1 above.

CR-3 participates in the Pressurized Water Reactor Owners Group (PWROG) MIRVP, to monitor the RV beltline materials that are projected to exceed a cumulative neutron fluence of 1×10^{17} n/cm^2 (E > 1.0 MeV) during 60 years of operation.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking Due to Stress-Corrosion Cracking and Intergranular Stress-Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the criteria in SRP-LR Section 3.1.2.2.4.

(1) LRA Section 3.1.2.2.4.1 states that this aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.4, item 1 states that cracking due to SCC and IGSCC may occur in the stainless steel and nickel-alloy BWR top head enclosure vessel flange leak detection lines. The staff finds that SRP-LR Section 3.1.2.2.4, item 1 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(2) LRA Section 3.1.2.2.4.2 states that this aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.4, item 2 states that cracking due to SCC and IGSCC may occur in stainless steel BWR isolation condenser components exposed to reactor coolant. The staff finds that SRP-LR Section 3.1.2.2.4, item 2 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs with an isolation condenser.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.4 criteria do not apply.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

In LRA Section 3.1.2.2.5, the applicant stated that crack growth due to cyclic loading (i.e., underclad cracking) is a TLAA that must be evaluated in accordance with 10 CFR 54.21(c)(1) and that its TLAA evaluations are addressed in LRA Section 4.2.

In LRA Table 3.1.1, the applicant identified item 3.1.1-21 as a TLAA item for reactor vessel shell fabricated of SA208-Cl 2 forgings clad with stainless steel using a high-heat input welding process. The applicant performed crack growth due to cyclic loading analysis for this component. SER Section 4.2 documents the staff's review of the applicant's evaluation of the TLAA for this component.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against criteria in SRP-LR Section 3.1.2.2.6 which recommends no further AMR if the applicant provides a commitment in the FSAR supplement to participate in the industry programs for investigating and managing aging effects on reactor internals, evaluate and implement the results of the industry programs as applicable to the reactor internals, and upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff noted that the applicant's commitment (Commitment No. 1) described in LRA Section A.1.1 is consistent with the commitment described in SRP-LR Section 3.1.2.2.6. The staff also noted that all of the AMR results that refer to LRA Table 3.1.1, item 3.1.1-22 are aligned with the applicant's commitment as described in LRA Section A.1.1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitment and the AMR results refer to the commitment, consistent with the recommendations of the GALL Report.

Based on the commitment identified above, the staff concludes that the applicant's proposed aging management meets the SRP-LR Section 3.1.2.2.6 criteria. For those line items that apply to LRA Section 3.1.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Stress-Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the criteria in SRP-LR Section 3.1.2.2.7.

(1) LRA Table 3.1.1, item 3.1.1-23 refers to LRA Section 3.1.2.2.7.1 and addresses stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes exposed to reactor coolant which are being managed for cracking due to SCC by a combination of the Water Chemistry Program and the One-Time Inspection Program. The applicant further stated that cracking due to SCC in the detector instrumentation piping is managed by a combination of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and the Water Chemistry Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the One-Time Inspection Program provides an inspection that either verifies that degradation is not occurring or triggers additional actions to maintain component-intended functions during the period of extended operation. The applicant also stated that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been shown to be an effective program for managing aging effects in Class 1, 2, and 3 components and their integral attachments.

    The staff reviewed LRA Section 3.1.2.2.7.1 against the criteria in SRP-LR Section 3.1.2.2.7, item 1, which states that cracking due to SCC could occur for stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The SRP-LR also states that a further evaluation should be conducted to ensure that these aging effects are adequately managed and that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed.

The staff's evaluations of the applicant's Water Chemistry; One-Time Inspection; and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD programs are documented in SER Sections 3.0.3.1.2, 3.0.3.1.9, and 3.0.3.1.1, respectively. In its review, the staff finds that the credited programs are adequate to manage the aging effect because the Water Chemistry Program monitors the plant water chemistry parameters against the established parameter limits and, if a parameter exceeds the limit, the program performs adequate actions such that the water chemistry control continues to mitigate the aging effect, and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program includes inspections of selected components to verify the effectiveness of the Water Chemistry Program consistent with the GALL Report, and the inspections in accordance with ASME Code Section XI can ensure that significant degradation is not occurring and the intended function of the component is maintained during the period of extended operation consistent with the GALL Report. The One-Time Inspection Program can ensure that significant degradation is not occurring and the component's intended function is maintained during the period of extended operation.

(2) LRA Table 3.1.1, item 3.1.1-24, refers to LRA Section 3.1.2.2.7.2, which addresses cracking due to SCC in PWR CASS piping and components exposed to reactor coolant. The applicant stated that screening based on ferrite and carbon content has not been used as a susceptibility criterion for CASS components. The applicant stated that this line item is not applicable because these components have been aligned to either LRA Table 3.1.1, item 3.1.1-68 or item 3.1.1-70.

The staff reviewed LRA Section 3.1.2.2.7.2 against the criteria in SRP-LR Section 3.1.2.2.7, item 2, which states that cracking due to SCC could occur for Class 1 PWR CASS reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The SRP-LR also states that the existing program relies on control of water chemistry to mitigate SCC; however, SCC could occur for CASS components that do not meet the NUREG-0313 guidelines with regard to ferrite and carbon content. The GALL Report recommends further evaluation of a plant-specific program for these components to ensure that this aging effect is adequately managed.

The staff reviewed NUREG-0313 and noted that the susceptibility criterion for CASS components is a maximum of 0.035 percent carbon and a minimum of 7.5 percent ferrite that are resistant to this aging effect. The staff noted that the applicant conservatively included, and will manage, cracking due to SCC for its Class 1 PWR CASS reactor coolant system piping, piping components, and piping elements exposed to reactor coolant and did not attempt to screen out CASS components based on the susceptibility criterion. The staff further noted that these components were aligned to LRA Table 3.1.1, item 3.1.1-68 or 3.1.1-70.

The staff noted that for those CASS components that align to items 3.1.1-68 and 3.1.1-70, the applicant has credited its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program. The staff's evaluations of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and Water Chemistry Program are documented in SER Sections 3.0.3.1.1 and 3.0.3.1.2, respectively. The staff determined that the ASME

Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program consists of periodic volumetric, surface, and/or visual examination of the components to detect degradation of components and determine appropriate corrective actions. The staff noted that inspection techniques performed as part of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are proven capable of detecting cracking due to SCC and that detected flaws are evaluated consistent with the requirements of ASME Code Section XI. The staff also noted that this program will perform periodic volumetric inspections of ASME Code Class 1 small-bore piping socket welds or a destructive examination may be performed on an opportunistic basis in lieu of the volumetric examinations. The staff determined that the Water Chemistry Program consists of monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limits such that an environment conducive for cracking is not present and the applicant's use of this program is consistent with recommendations of SRP-LR Section 3.1.2.2.7, item 2.

Based on its review, the staff finds the applicant's determination and alignment of CASS components with items 3.1.1-68 and 3.1.1-70 acceptable because the applicant conservatively did not screen out CASS components for aging management based on the susceptibility criterion in NUREG-0313, manages cracking due to SCC with its Water Chemistry Program, consistent with the recommendations of SRP-LR Section 3.1.2.2.7 item 2, and credits its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program that consists of inspection techniques that are proven capable of detecting cracking due to SCC and include flaw evaluations.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.7 criteria. For those line items that apply to LRA Section 3.1.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.8 Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8.

(1) LRA Section 3.1.2.2.8.1 states that the aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.8, item 1 states that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines. The staff finds that SRP-LR Section 3.1.2.2.8, item 1 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(2) LRA Section 3.1.2.2.8.2 states that the aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.8, item 2 states that cracking due to cyclic loading may occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The staff finds that SRP-LR Section 3.1.2.2.8, item 1 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.8 criteria do not apply.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

LRA Section 3.1.2.2.9 addresses loss of preload due to stress relaxation in stainless steel and nickel-alloy PWR RVI components exposed to reactor coolant. The staff reviewed LRA Section 3.1.2.2.9 against criteria in SRP-LR Section 3.1.2.2.9 which recommends no further AMR if the applicant provides a commitment in the FSAR supplement to participate in the industry programs for investigating and managing aging effects on reactor internals, evaluate and implement the results of the industry programs as applicable to the reactor internals, and upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff noted that the applicant's commitment (Commitment No. 1) as described in LRA Section A.1.1 is consistent with the commitment described in SRP-LR Section 3.1.2.2.9. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-27 are aligned with the applicant's commitment as described in LRA Section A.1.1. The staff finds the applicant's proposal acceptable because the applicant provided the appropriate commitment and the AMR results refer to the commitment, consistent with the recommendations of the GALL Report.

Based on the commitment identified above, the staff concludes that the applicant's proposed aging management meets the SRP-LR Section 3.1.2.2.9 criteria. For those line items that apply to LRA Section 3.1.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.10 Loss of Material Due to Erosion

LRA Section 3.1.2.2.10 corresponds to SRP-LR Section 3.1.2.2.10 which addresses the steel steam generator feedwater impingement plate and support exposed to secondary feedwater. The GALL Report recommends use of a plant-specific AMP to be evaluated to manage loss of material due to erosion for this component group. The applicant stated that this line item is not applicable because this component, material, environment, and aging effect/mechanism combination does not apply to the reactor vessel, RVIs, and RCS. The staff reviewed LRA Sections 2.3.1.1 and 3.1 and confirmed that the applicant's LRA does not have any AMR results that include the steel steam generator feedwater impingement plate and support exposed to secondary feedwater. The staff reviewed the GALL Report AMR item IV.D1-13, which is associated with LRA Table 3.1.1, item 3.1.1-28 and noted the recommendation for aging management is specific to the steel steam generator feedwater impingement plate and support for recirculating steam generators. The staff reviewed FSAR Section 4.2.1.1 and FSAR Figures 4-1 and 4-5 and confirmed that the applicant uses OTSGs and, therefore, finds the applicant's determination acceptable.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

LRA Section 3.1.2.2.11 states that the aging effect is applicable to BWRs only. SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The staff finds that SRP-LR Section 3.1.2.2.11 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.11 criteria do not apply.

3.1.2.2.12 Cracking Due to Stress-Corrosion Cracking and Irradiation-Assisted Stress-Corrosion Cracking

LRA Section 3.1.2.2.12 addresses cracking due to SCC and IASCC in PWR stainless steel reactor internals exposed to reactor coolant. The applicant proposed to manage the RVI components exposed to reactor coolant with the Water Chemistry Program. The staff reviewed LRA Section 3.1.2.2.12 against criteria in SRP-LR Section 3.1.2.2.12 which recommends use of the Water Chemistry Program and no further AMR if the applicant provides a commitment in the FSAR supplement to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff noted that the applicant’s commitment (Commitment No. 1) as described in LRA Section A.1.1 is consistent with the commitment described in SRP-LR Section 3.1.2.2.12. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-30 credit the Water Chemistry Program and are aligned with the applicant’s commitment as described in LRA Section A.1.1. The staff reviewed the applicant’s Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The staff finds the applicant’s proposal acceptable because the applicant uses the Water Chemistry Program that mitigates these aging effects and because the applicant has provided the appropriate commitment and the AMR results refer to the commitment, consistent with the recommendations of the GALL Report.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.1.2.2.12 criteria. For those line items that apply to LRA Section 3.1.2.2.12, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.13 Cracking Due to Primary Water Stress-Corrosion Cracking

LRA Table 3.1.1, item 3.3.1-31 refers to LRA Section 3.1.2.2.13 and addresses nickel-alloy and low alloy steel with nickel-alloy cladding, including RCPB components and penetrations inside the RCS such as pressurizer heater sheaths and sleeves, nozzles, and other internal components exposed to reactor coolant which are being managed for cracking due to PWSCC by the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. In addition, the applicant provided in the FSAR supplement a commitment to comply with applicable NRC orders and to implement applicable bulletins and GLs and staff-accepted industry guidelines. The applicant addressed the further evaluation requirements by stating that the Water Chemistry Program provides for monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the cracking aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program has been shown to be effective in managing aging effects in Class 1, 2, or 3 components and their integral attachments in light water-cooled power plants.

The staff reviewed LRA Section 3.1.2.2.13 against the criteria described in SRP–LR Section 3.1.2.2.13, which states that cracking due to PWSCC could occur in nickel alloy and steel with nickel-alloy cladding PWR components including RCPB components and penetrations inside the RCS such as pressurizer heater sheathes and sleeves, nozzles, and other internal components exposed to reactor coolant. The SRP-LR also stated that with the exception of reactor vessel upper head nozzles and penetrations, the GALL Report recommends ASME Section XI, Inservice Inspection (for Class 1 components) and control of water chemistry. For nickel-alloy components, no further AMR is necessary if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR supplement to implement applicable Bulletins and GLs and staff-accepted industry guidelines.

The staff reviewed the applicant's Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.1, respectively. In its review of components associated with LRA Table 3.1.1, item 3.1.1-31, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program acceptable because the applicant is managing these components consistent with the recommendations in GALL Report AMR items IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-21 and IV.D2-2, the applicant's ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program performs periodic volumetric, surface, and/or visual examination that is capable of detecting cracking due PWSCC. The applicant's Water Chemistry Program controls peak levels of various contaminants (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) below the system-specific limits that can accelerate corrosion and cracking and for nickel -alloy and low alloy steel with nickel-alloy cladding components, and the applicant committed (Commitment No. 2) to comply with applicable NRC orders to implement applicable Bulletins and Generic Letters and staff-accepted industry guidelines.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.13 criteria. For those items that apply to LRA Section 3.1.2.2.13, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

LRA Table 3.1.1, item 3.1.1-32, refers to LRA Section 3.1.2.2.14 which addresses steel steam generator feedwater inlet ring and supports exposed to secondary feedwater and steam. The GALL Report recommends use of a plant-specific AMP be evaluated to manage wall thinning due to flow-accelerated corrosion for this component group. The applicant stated that LRA Table 3.1.1, item 3.1.1-32 is not applicable. The applicant also stated that wall thinning due to flow-accelerated corrosion in the steel feedwater inlet header is discussed in LRA Table 3.4.1, item 3.4.1-29. The staff reviewed LRA Sections 2.3.1.1 and 3.1 and confirmed that the applicant's LRA does not have any AMR results that include steel steam generator feedwater inlet ring and supports exposed to secondary feedwater and steam. The staff reviewed GALL Report, item IV.D1-26, which is associated with item 3.1.1-32, and noted the recommendations for aging management are specific to the steel steam generator feedwater inlet ring and supports for recirculating steam generators. The staff reviewed FSAR Section 4.2.1.1 and FSAR Figures 4-1 and 4-5 and confirmed that the applicant uses OTSGs and, therefore, finds the applicant's determination acceptable. The staff also confirmed that wall thinning due to flow-accelerated corrosion in the steel feedwater inlet header, addressed in item 3.4.1-29, is managed by the applicant's Flow-Accelerated Corrosion Program, consistent with GALL Report items VIII.D1-9, VIII.E-35, and VIII.F-26 and, therefore, is acceptable.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

LRA Section 3.1.2.2.15 addresses changes in dimensions due to void swelling in stainless steel and nickel-alloy PWR RVI components exposed to reactor coolant. The staff reviewed LRA Section 3.1.2.2.15 against criteria in SRP-LR Section 3.1.2.2.15 which recommends no further AMR if the applicant provides a commitment in the FSAR supplement to participate in the industry programs for investigating and managing aging effects on reactor internals, evaluate and implement the results of the industry programs as applicable to the reactor internals, and upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff noted that the applicant’s commitment (Commitment No. 1) as described in LRA Section A.1.1 is consistent with the commitment described in SRP-LR Section 3.1.2.2.15. The staff also noted that all of the AMR results that refer to LRA Table 3.1.1, item 3.1.1-33 are aligned with the applicant’s commitment as described in LRA Section A.1.1. The staff finds the applicant’s proposal acceptable because the applicant provided the appropriate commitment and the AMR results refer to the commitment, consistent with the recommendations of the GALL Report.

Based on the commitment identified above, the staff concludes that the applicant’s proposed aging management meets the SRP-LR Section 3.1.2.2.15 criteria. For those line items that apply to LRA Section 3.1.2.2.15, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.16 Cracking Due to Stress-Corrosion Cracking and Primary Water Stress-Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16.

(1) LRA Table 3.1.1, items 3.1.1-34 and 3.1.1-35 refer to LRA Section 3.1.2.2.16.1 and address low alloy steel with stainless steel cladding and stainless steel CRD head penetration pressure housings exposed to reactor coolant and low alloy steel with stainless steel or nickel-based alloy cladding and stainless steel steam generator components which are being managed for cracking due to SCC and PWSCC by the Water Chemistry Program; ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program; and commitments to comply with applicable NRC Orders and to implement applicable Bulletins and GLs and staff-accepted industry guidelines, as applicable to nickel-alloy components. The applicant addressed the further evaluation requirements by stating that it covers the OTSG primary side components including upper and lower heads, tubesheets, and tube-to-tubesheet welds. The applicant further identified that the reactor CRD head penetration pressure housing, the primary man-way, and inspection opening cover backing plates are constructed of stainless steel; therefore, the commitment to comply with applicable NRC orders regarding cracking of nickel-alloy components is not applicable. The applicant further identified that the tube support plates are made of steel and are not susceptible to SCC.

The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16, which states that cracking due to SCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with stainless steel. Similarly, the SRP-LR states that cracking due to PWSCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with nickel-alloy. The GALL Report, under items IV.A2-11 and IV.D2-4, recommends ASME Section XI Inservice Inspection and control of water chemistry to manage this aging effect. In addition, the GALL Report recommends no further AMR for PWSCC of nickel-alloy if the applicant complies with applicable NRC orders and provides a commitment in the FSAR supplement to implement applicable (i) Bulletins and Generic Letters, and (ii) staff-accepted industry guidelines.

The staff reviewed the applicant's Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.1, respectively. In its review of components associated with LRA Table 3.1.1, items 3.1.1-34 and 3.1.1-35, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and a commitment for nickel-alloy components acceptable because, the applicant is managing these components consistent with the recommendations in GALL Report AMR items IV.A2-11 and IV.D2-4. Also, the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program performs periodic volumetric, surface, and/or visual examination that is capable of detecting cracking due to SCC and PWSCC, the applicant's Water Chemistry Program controls peak levels of various contaminants (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) below the system-specific limits that can accelerate corrosion and cracking and for nickel-alloy components; and the applicant committed (Commitment No. 2) to comply with applicable NRC Orders to implement applicable Bulletins and GLs and staff accepted industry guidelines.

(2) LRA Table 3.1.1, item 3.1.1-36 refers to LRA Section 3.1.2.2.16, item 2 and addresses stainless steel, steel, and nickel-alloy pressurizer spray heads exposed to reactor coolant. The GALL Report recommends GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.M32, "One-Time Inspection," and for nickel-alloy welded spray heads, the GALL Report recommends no further AMR if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR supplement to implement applicable: (a) Bulletins and GLs, and (b) staff-accepted industry guidelines. The applicant stated that this line item is not applicable because the pressurizer spray head has no intended function.

By letter dated December 1, 2009, the staff issued RAI 3.1.2.2.16.2-1 requesting that the applicant provide additional information as to why the pressurizer spray head does not need to be considered for any aging degradation mechanisms and as such, controlled under an AMP. In its response dated December 30, 2009, the applicant stated that the pressurizer spray head and associated internal spray lines did not support the pressurizer pressure boundary. In addition, the applicant stated that the industry experience did not support a scenario where the failure of the spray head or internal spray lines would lead to a loss of the pressurizer pressure boundary. As such, the applicant stated that the spray heads and internal spray lines are not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.2.16.2-1 and the applicant's claim that the pressurizer spray head has no intended function that would place it within the scope of license renewal acceptable because the spray head and internal spray lines do not support the pressurizer pressure boundary and are not within the scope of license renewal in accordance with 10 CFR 54.4(a). The staff's concern described in RAI 3.1.2.2.16.2-1 is resolved.

The staff concludes that the components addressed by the LRA and SRP-LR Section 3.1.2.2.16, item 2 are not within the scope of license renewal, therefore, the management of the aging of these components as required by 10 CFR 54.21(a)(3) is not applicable to the pressurizer spray head.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.16 criteria. For those line items that apply to LRA Section 3.1.2.2.16, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.17 Cracking Due to Stress-Corrosion Cracking, Primary Water Stress-Corrosion Cracking, and Irradiation Assisted Stress-Corrosion Cracking

LRA Section 3.1.2.2.17 addresses cracking due to SCC, PWSCC, or IASCC in stainless steel and nickel-alloy PWR RVI components. The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17 which recommends use of the Water Chemistry Program and no further AMR if the applicant provides a commitment in the FSAR supplement to participate in the industry programs for investigating and managing aging effects on reactor internals, evaluate and implement the results of the industry programs as applicable to the reactor internals, and upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff noted that the applicant's commitment (Commitment No. 1) as described in LRA Section A.1.1 is consistent with the commitment described in SRP-LR Section 3.1.2.2.17. The staff also noted that all of the AMR results lines that refer to LRA Table 3.1.1, item 3.1.1-37 credit the Water Chemistry Program and are aligned with the applicant's commitment as described in LRA Section A.1.1. The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The staff finds the applicant's proposal acceptable because the applicant credits the Water Chemistry Program which mitigates these aging effects and because the applicant has provided the appropriate commitment and the AMR results refer to the commitment, consistent with the recommendations of the GALL Report.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.17 criteria. For those line items that apply to LRA Section 3.1.2.2.17, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.1.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.1.2-1 through 3.1.2-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-3, via notes F through J, the applicant indicated which combinations of component type, material, environment, and AERM do not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component, nor the material and environment combination, for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.1.2.3.1 Reactor Coolant System–Summary of Aging Management Review–LRA Table 3.1.2-1

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the RCS component groups.

In LRA Table 3.1.2-1, the applicant stated that for the CASS reactor vessel internals, incore guide tube spider castings, and nickel-based alloy reactor vessel internals surveillance specimen holder bolts, core barrel-to-thermal shield bolts and lower internals assembly-to-thermal shield bolts, and the reactor vessel instrument tubes (bottom head), and stainless steel reactor vessel internals core barrel-to-thermal shield bolts, surveillance specimen holder bolts, orifice plugs, lower internals assembly-to-thermal shield bolts, incore guide tube components, shell forging-to-flow distributor bolts, incore guide support plate and thermal shield exposed reactor coolant (internal or external) are subject to cracking due to flow-induced vibration. The AMR line items cite generic note H and a plant-specific note 102 that states flow-induced vibration of the reactor vessel internals has been identified as a TLAA.

The staff notes that high cycle fatigue and low cycle fatigue are governed by the same failure mechanism, as characterized by progressive damage caused by repeated alternating stresses operating below the designed load carrying capacity, regardless of the type or origin of loads: thermal, pressure, or external mechanical in nature. However, flow-induced high cycle fatigue involves no thermal stress, and the alternating stress that the components experience are typically mild. The staff verified that the applicant presented its evaluation of fatigue due to flow induced high cycle fatigue in LRA Section 4.3.1.2. The staff's evaluation for the flow-induced high cycle fatigue is documented in SER Section 4.3.1.

The staff verified that the applicant provided its TLAA evaluation in LRA Section 4.3.1 for the NSSS components included in this section. The staff's evaluation of the fatigue TLAA for the NSSS components is documented in SER Section 4.3.1.

In LRA Table 3.1.2-1, the applicant stated that the nickel-based alloy reactor vessel internals and fuel assembly support pads for the lower grid assembly and the upper grid assembly exposed to reactor coolant are being managed for SCC by the Water Chemistry Program and Reactor Vessel Internals Commitment. The AMR line items cite generic note F.

The staff noted that the applicant referenced GALL Report items IV.B4-29 and IV.B4-44, which are applicable to stainless steel fuel assembly support pads: lower grid assembly and upper grid assembly, respectively, exposed to reactor coolant and subject to cracking due to SCC. The staff noted that the GALL Report recommends the use of GALL AMP XI.M2 and a licensee commitment to participate in the industry programs for investigating and managing aging effects on reactor internals, evaluate and implement the results of the industry programs as applicable to the reactor internals, and upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff further noted that stainless steel and nickel-based alloys are both austenitic alloys and thus subject to the same aging effects, therefore, the staff finds the applicant identified an appropriate aging effect for this component. The staff further noted the applicant is managing associated aging effects, such as change in dimensions due to void swelling and loss of fracture toughness due to neutron irradiation embrittlement and void swelling, consistent with the recommendations in the GALL Report. The staff determined that the GALL Report's recommendations for managing these aging effects are also applicable to these nickel-based alloy components.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The staff noted the applicant's Water Chemistry Program controls peak levels of various contaminants (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) below the system-specific limits that can accelerate age-related degradation. The staff also noted that the applicant provided Commitment No. 1 which states the following:

> In accordance with the guidance of NUREG-1801, Rev. 1, regarding aging management of reactor vessel internals components, CR-3 will: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and, (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff finds the applicant's proposal to manage aging using the Water Chemistry Program acceptable because it is consistent with the recommendations of the GALL Report.

In LRA Table 3.1.2-1, the applicant stated that the nickel-based alloy reactor vessel internals; fuel assembly support pads (upper grid assembly) exposed to reactor coolant are being managed for change in dimensions due to void swelling and loss of fracture toughness due to neutron irradiation embrittlement and void swelling by the Reactor Vessel Internals Commitment. The AMR line item cites generic note F.

The staff noted that the applicant referenced GALL Report items IV.B4-45 and IV.B4-46, which are applicable to stainless steel fuel assembly support pads: upper grid assembly exposed to reactor coolant and subject to change in dimensions due to void swelling and loss of fracture toughness due to neutron irradiation embrittlement and void swelling, respectively. The staff noted that the GALL Report recommends a licensee commitment to: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval. The staff further noted that stainless steel and nickel-based alloys are both austenitic alloys and thus subject to the same aging effects, therefore, the staff finds the applicant identified the appropriate aging effects for this component. The staff determined that the GALL Report's recommendations for managing these aging effects are also applicable to these nickel-based alloy components.

The staff noted that the applicant provided Commitment No. 1 which states the following:

> In accordance with the guidance of NUREG-1801, Rev. 1, regarding aging management of reactor vessel internals components, CR-3 will: (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and, (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

The staff finds the applicant's proposal to manage aging using the above commitment acceptable because it is consistent with the recommendations of the GALL Report.

In LRA Table 3.1.2-1, the applicant stated that the nickel base alloy vent valve assembly locking device, fuel assembly support pads (lower and upper grid assembly) and guide blocks and bolts of the reactor vessel internals exposed to reactor coolant are being managed for loss of material due to wear by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The AMR line items cite generic note F.

The staff reviewed LRA Table 3.1.2-1 and noted that the aging effects the applicant has identified for each of these components encompasses those aging effects that nickel alloy components exposed to reactor coolant are subject to. The staff noted the applicant has addressed cracking due to SCC, change in dimensions due to void swelling, loss of fracture toughness due to neutron irradiation embrittlement and void swelling and loss of material due to pitting and crevice corrosion. Furthermore, the applicant identified the fuel assembly support pads (lower and upper grid assembly) and guide blocks and bolts as subject to cumulative fatigue damage because there was an applicable TLAA associated with these components. The staff reviewed the associated line items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material and environmental combination and has also conservatively identified loss of material due to wear for these components.

The staff reviewed the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and its evaluation is documented in SER Section 3.0.3.1.1. The staff noted that the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program consists of periodic volumetric, surface, and/or visual examination, and leakage testing of Class 1, 2, and 3 pressure retaining components and their integral attachments to detect degradation of components and determine, if needed, appropriate corrective actions. The staff finds the applicant's proposal to manage aging using the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program acceptable because the program will perform inspections capable of detecting the aging effect of loss of material due to wear, and the applicant will determine appropriate corrective actions, to ensure structural integrity of the components and to ensure the intended functions are maintained.

In LRA Table 3.1.2-1, the applicant stated that the nickel-based alloy steam generator secondary side nozzles (vent, drain, and instrumentation), main feedwater nozzle spray plates and auxiliary feedwater nozzle thermal sleeves exposed to treated water (outside) are being managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program and the One-Time inspection Program. The AMR line item cites generic note F.

The staff reviewed the associated line items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material and environmental combination because the applicant is managing cumulative fatigue damage and cracking due to SCC for these components and is conservatively also managing loss of material due to pitting and crevice corrosion. The staff also reviewed other LRA items associated with these components and found that, when all associated line items are considered, the applicant has identified all credible aging effects and managed them, even if they are not included in the GALL Report.

The staff's evaluations of the applicant's Water Chemistry Program and One-Time Inspection Program are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff noted the Water Chemistry Program is used to control water chemistry for impurities (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion and cracking. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below the system-specific limit. Furthermore, the applicant may add chemical agents, such as corrosion inhibitors, oxygen scavengers, and biocides, to prevent certain aging mechanisms. The staff noted that the applicant will update its Water Chemistry Program, based on the latest revision of the EPRI guidelines, as revisions of these guidelines will be released. The staff also noted that the applicant's One-Time Inspection Program includes verification inspections specified by the GALL Report for the Water Chemistry Program. The staff noted that prior to the period of extended operation, procedural controls for this program will be implemented to track, initiate, complete, and report activities associated with one-time inspections for the steam generator components that credit the Water Chemistry Program for aging management of loss of material. The staff determined that the applicant's One-Time Inspection Program will verify the effectiveness of its Water Chemistry Program. The staff finds the applicant's proposal to manage aging using the Water Chemistry Program and One-Time Inspection Program acceptable because the applicant will preventively manage the loss of material due to crevice and pitting corrosion of nickel-based alloy steam generator components with the appropriate GALL AMP XI.M2, and verify its effectiveness with GALL AMP XI.M32, which is capable of detecting this aging effect for similar components in the same environment.

In LRA Table 3.1.2-1, the applicant stated that the nickel-based alloy steam generator tubes and sleeves exposed to reactor coolant (inside) and to treated water (outside) are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Steam Generator Tube Integrity Program and the Water Chemistry Program. The AMR line item cites generic note H. Plant-specific note 104 is also cited, which states that the GALL Report does not identify fouling of the steam generator tubes as an applicable aging effect and that no plant's operating experience has been identified for fouling of steam generator tubes. The applicant further stated in plant-specific note 104 that the absence of fouling is considered largely due to the plant water chemistry program.

The staff reviewed the associated line items in the LRA and noted that it was not clear whether the aging mechanism of fouling from the inside diameter (ID) surface of the steam generator tubes, which is in contact with the reactor coolant, had been detected at any U.S. nuclear plant and should be taken into account. In addition, it was unclear to the staff whether the applicant has observed any fouling of its steam generator tubes on their primary side, secondary side or both. Moreover, the staff noted that the applicant did not explain how the Water Chemistry Program and, specifically, the Steam Generator Tube Integrity Program could manage ID fouling of the steam generator tube.

By letter dated December 1, 2009, the staff issued RAI 3.1.2.1-6 requesting that the applicant explain why it has selected the aging mechanism of fouling of the steam generator tubes from the inside surface and discuss how the AMPs it credited, especially the Steam Generator Tube Integrity Program, could manage this aging effect.

In its response dated December 30, 2009, the applicant stated that although there is no plant-specific operating experience related to reduction of heat transfer effectiveness due to fouling of heat transfer surfaces on both the primary and secondary sides of the steam generator tubes, its AMR methodology assumed the aging effect was applicable in the absence of water chemistry control. The applicant further stated that its aging management strategy will be updated to delete the reliance on the Steam Generator Tube Integrity Program as follows: reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of the primary and secondary sides of the tubes will be managed by the Water Chemistry Program only. The applicant amended its LRA Table 3.1.2-1 accordingly and modified note H to J. The applicant further stated that the GALL Report directs the use of the Water Chemistry Program to manage corrosion on the primary side similarly for stainless steel and nickel-based alloys and for managing reduction of heat transfer due to fouling of stainless steel heat exchanger tubes. Therefore, the applicant considered the use of the Water Chemistry Program to manage nickel-based alloy heat exchanger tubes for this aging effect as acceptable.

The staff reviewed the applicant’s response to RAI 3.1.2.1-6 and finds it not acceptable because the staff noted that the GALL Report states that for stainless steel heat exchanger tubes exposed to treated water, control of water chemistry may have been inadequate, and recommends that the effectiveness of the chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. Even though it has not been observed in the applicant’s SGs, the staff also noted that, there is applicable industry operating experience for the aging effect of reduction of heat transfer due to fouling of the steam generator tubes secondary surface, as identified in NRC IN 2007-37. It was not clear to the staff why the applicant modified its LRA by only crediting the Water Chemistry Program, without any effectiveness verification program for managing this aging effect for the external surfaces of steam generator tubes, and no longer uses the Steam Generator Tube Integrity Program. The staff noted that the Steam Generator Tube Integrity Program includes secondary activities related to fouling, consistent with industry guidelines, such as EPRI PWR Water Chemistry Guidelines and NEI 97-06, “Steam Generator Program Guidelines,” as recommended in GALL AMPs XI.M2 and XI.M19. The staff considers the Steam Generator Tube Integrity Program as a water chemistry effectiveness verification program, consistent with the recommendations of the GALL Report and SRP-LR.

Therefore, by letter dated October 14, 2010, the staff issued follow-up RAI 3.1.2.1-6.1 requesting that the applicant justify the elimination of the Steam Generator Tube Integrity Program for verifying the effectiveness of the Water Chemistry Program in managing the aging effect of reduction of heat transfer due to fouling on the steam generator tube external surfaces, or revise its application to include this program, to verify the effectiveness of the Water Chemistry Program, consistent with the recommendations of the GALL Report.

In its response dated November 12, 2010, the applicant amended its LRA to include the Steam Generator Tube Integrity Program for managing reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for the external surfaces of nickel-based alloy steam generator tubes.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.2-6.1 acceptable because the applicant credited the Steam Generator Tube Integrity Program that includes secondary activities related to fouling consistent with industry guidelines for verifying the effectiveness of the Water Chemistry Program. The staff's concerns described in RAIs 3.1.2.1-6 and 3.1.2.1-6.1 are resolved.

The staff's evaluations of the applicant's Water Chemistry Program and Steam Generator Tube Integrity Program are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.8, respectively. The staff noted that the Water Chemistry Program is used to control water chemistry for impurities and allows the introduction of chemical agents, such as corrosion inhibitors, oxygen scavengers, and biocides that should preclude the accumulation of deposits. Moreover, the staff noted that the Steam Generator Tube Integrity Program provides the requirements for inspection activities for the secondary-side internal components needed to maintain tube integrity and includes degradation assessments that identify both potential and existing degradation mechanisms. The staff finds the applicant's proposal to manage aging using the Steam Generator Tube Integrity Program and Water Chemistry Program acceptable because the applicant will manage the relevant aging effect of reduction of heat transfer effectiveness due to fouling of heat transfer surfaces from outside steam generator tubes surface, and will preventively manage the unlikely fouling of heat transfer surfaces from inside steam generator tubes surface with the Water Chemistry Program.

In LRA Tables 3.1.2-1, 3.3.2-30, and 3.3.2-39, the applicant stated that stainless steel piping, piping components, piping elements, and RCP motor lube oil collection drip pans exposed to lubricating oil are being managed for cracking due to SCC by the Lubricating Oil Analysis Program and One-Time Inspection Program. The AMR line items cite generic Note J.

The staff reviewed LRA Tables 3.1.2-1, 3.3.2-30, and 3.3.2-39 and noted that for the same stainless steel components the applicant identified loss of material due to pitting and crevice corrosion as an AERM. The staff further noted that the applicant credits its Lubricating Oil Analysis Program and the One-Time Inspection Program to manage loss of material due to pitting and crevice corrosion, consistent with the recommendations of the GALL Report. The staff noted that the applicant has identified those aging effects that are applicable to stainless steel components exposed to lubricating oil. The staff finds the applicant has conservatively identified that cracking due to SCC is an applicable AERM and, therefore, acceptable.

The staff reviewed the applicant's Lubricating Oil Analysis Program and the One-Time Inspection Program, and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.11, respectively. The applicant stated that the Lubricating Oil Analysis Program provides for periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits and that the One-Time Inspection Program will perform visual inspections of components exposed to lubricating oil to confirm the effectiveness of the Lubricating Oil Analysis Program. The staff finds the combination of the Lubricating Oil Analysis Program and One-Time Inspection Program acceptable to manage SCC of these stainless steel components because the combination of programs will limit the concentrations of contaminants in the lubricating oil and use visual inspection to verify the effectiveness of the program at managing the effects of SCC.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Control Rod Drive System–Summary of Aging Management Review–
LRA Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the CRD system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.1.2.3.3 Incore Monitoring System–Summary of Aging Management Review–
LRA Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the incore monitoring system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the reactor vessel, internals, and RCS components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features Systems

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety features (ESF) systems components and component groups of:

- reactor building spray system
- core flood system
- decay heat removal system

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF systems components and component groups. LRA Table 3.2.1, “Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the ESF system components and component groups.

The applicant’s AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry’s operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the ESF systems components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to ensure the applicant’s claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff’s evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff’s review are documented in SER Section 3.2.2.1.

The staff also reviewed selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations are consistent with the SRP-LR Section 3.2.2.2 acceptance criteria. The staff’s evaluations are documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff’s evaluations are documented in SER Section 3.2.2.3.

For SSCs which the applicant claimed are not applicable or required no aging management, the staff reviewed the AMR line items and the plant’s operating experience to verify the applicant’s claims.

Table 3.2-1 summarizes the staff’s evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.2 and addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Systems Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, and piping elements in the ECCS (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (see SER Section 3.2.2.2.1)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks"	Yes	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.2.2)
Stainless steel containment isolation piping and components internal surfaces exposed to treated water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program	Not applicable to CR-3 (see SER Section 3.2.2.2.3(1))
Stainless steel piping, piping components, and piping elements exposed to soil (3.2.1-4)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.2.3(2))
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.2.1-5)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.3(3))
Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.2.1-6)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.3(4))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Partially encased stainless steel tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Structures Monitoring Program	Consistent with GALL Report (see SER Section 3.2.2.2.3(5))
Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, Water Chemistry Program, and One Time-Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.3(6))
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.2.1-9)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.4(1))
Stainless steel heat exchanger tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.4(2))
Elastomer seals and components in standby gas treatment system exposed to air-indoor uncontrolled (3.2.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.5)
Stainless steel high-pressure safety injection (HPSI) (charging) pump miniflow orifice exposed to treated borated water (3.2.1-12)	Loss of material due to erosion	A plant-specific AMP is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (see SER Section 3.2.2.2.6)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air-indoor uncontrolled (internal) (3.2.1-13)	Loss of material due to general corrosion and fouling	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.7)
Steel piping, piping components, and piping elements exposed to treated water (3.2.1-14)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.2.8(1))
Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water (3.2.1-15)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.8(2))
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (see SER Section 3.2.2.2.8(3))
Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil (3.2.1-17)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance; or Buried Piping and Tanks Inspection	No Yes	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.2.9)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60 °C (>140 °F) (3.2.1-18)	Cracking due to SCC and IGSCC	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) > 250 °C (>482 °F) (3.2.1-20)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading and SCC	Bolting Integrity	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel closure bolting exposed to air with steam or water leakage (3.2.1-22)	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel bolting and closure bolting exposed to air-outdoor (external) or air-indoor uncontrolled (external) (3.2.1-23)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Steel closure bolting exposed to air-indoor uncontrolled (external) (3.2.1-24)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60 °C (>140 °F) (3.2.1-25)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-26)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.2.1-27)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-28)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-29)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water (3.2.1-30)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air-indoor uncontrolled (external); condensation (external) and air-outdoor (external) (3.2.1-31)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report
Steel piping and ducting components and internal surfaces exposed to air-indoor uncontrolled (Internal) (3.2.1-32)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel encapsulation components exposed to air-indoor uncontrolled (internal) (3.2.1-33)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to condensation (internal) (3.2.1-34)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to PWRs (see SER Section 3.2.2.1.1)
Steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-35)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to raw water (3.2.1-36)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-37)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel containment isolation piping and components internal surfaces exposed to raw water (3.2.1-38)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.2.1-39)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water (3.2.1-40)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy > 15%Zn piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-41)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water (3.2.1-42)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-43)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Gray cast iron motor cooler exposed to treated water (3.2.1-44)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Aluminum, copper alloy > 15% Zn, and steel external surfaces, bolting, and piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-45)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Steel encapsulation components exposed to air with borated water leakage (internal) (3.2.1-46)	Loss of material due to general, pitting, crevice, and boric acid corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
CASS piping, piping components, and piping elements exposed to treated borated water >250 °C (> 482 °F) (3.2.1-47)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or stainless steel clad steel piping, piping components, piping elements, and tanks (including safety injection tanks/accumulators) exposed to treated borated water >60 °C (>140 °F) (3.2.1-48)	Cracking due to SCC	Water Chemistry	No	Boric Acid Corrosion Program	Consistent with GALL Report
Stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water (3.2.1-49)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report
Aluminum piping, piping components, and piping elements exposed to air-indoor uncontrolled (internal/external) (3.2.1-50)	None	None	NA	None	Consistent with GALL Report
Galvanized steel ducting exposed to air-indoor controlled (external) (3.2.1-51)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Glass piping elements exposed to air-indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water (3.2.1-52)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Stainless steel, copper alloy, and nickel-alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (external) (3.2.1-53)	None	None	NA	None	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air-indoor controlled (external) (3.2.1-54)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, and piping elements in concrete (3.2.1-55)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	NA	None	Consistent with GALL Report
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-57)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.2.2.1.1)

The staff's review of the ESF systems component groups followed any one of several approaches. One approach, documented in SER Section 3.2.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.2.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.2.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs, credited to manage or monitor aging effects of the ESF systems components, is documented in SER Section 3.0.3.

3.2.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.2.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the ESF systems components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

- Nickel Alloy Commitment
- One-Time Inspection Program
- Water Chemistry Program

LRA Tables 3.2.2-1 through 3.2.2-3 summarize AMRs for the ESF systems components and indicate AMRs claimed to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMR's that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the ESF systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable, and no further staff review is required.

3.2.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.2.1, items 3.2.1-18, 3.2.1-19, 3.2.1-20, and 3.2.1-34, discuss the applicant's determination that these line items are applicable only to BWRs. The staff verified that these items do not apply because CR-3 is a PWR design. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR items 3.2.1-18, 3.2.1-19, 3.2.1-20, and 3.2.1-34 are not applicable.

LRA Table 3.2.1, item 3.2.1-21, addresses high-strength steel closure bolting exposed to air with steam or water leakage in the engineered safety features systems. The applicant stated that this item is not applicable because there is no high strength closure bolting in the engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include high strength steel closure bolting exposed to air with steam or water leakage. The staff reviewed the applicant's FSAR and confirmed that no in-scope high-strength steel closure bolting exposed to air with steam or water leakage is present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-22, addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends use of GALL AMP XI.M18, "Bolting Integrity," to manage loss of material due to general corrosion for this component group. The applicant stated that this item is not applicable because the CR-3 AMR methodology includes the air with steam or water leakage environment with the air-indoor uncontrolled environment and, therefore, components subject to that environment have been rolled up to LRA Table 3.2.1, item

3.2.1-23. The staff evaluated the applicant's claim and found it acceptable because the applicant identified the loss of material due to general corrosion aging effect, and the applicant has credited an alternate Table 1 item to manage this component group.

LRA Table 3.2.1, item 3.2.1-26, addresses loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features system that include steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also reviewed the applicant's FSAR confirmed that no in-scope steel piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the engineered safety features system and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-29, addresses loss of material due to pitting, crevice, and galvanic corrosion in copper alloy piping, piping components, piping elements, and heat exchanger tubes exposed to closed-cycle cooling water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features system that include copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope copper alloy piping, piping components, piping elements, and heat exchanger tubes exposed to closed cycle cooling water are present in the engineered safety features system and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-32, addresses steel piping and ducting components and internal surfaces exposed to air-indoor uncontrolled (internal). The applicant stated that this item is not applicable because the reactor building spray piping is fabricated of stainless steel. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include steel piping and ducting components and internal surfaces exposed to air-indoor uncontrolled (internal). The staff also reviewed the applicant's FSAR and confirmed that there are no in-scope steel piping and ducting components internal surfaces exposed to air-indoor uncontrolled in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-33, addresses steel encapsulation components exposed to air-indoor uncontrolled (internal) being managed for loss of material due to general, pitting, and crevice corrosion. The GALL Report recommends that this aging effect be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant stated that this item is not applicable because the valve chambers (steel encapsulation components) are treated as structural commodities and included with the penetration sleeves for the purposes of AMR. The applicant referenced LRA Table 3.5.1, item 3.5.1-18, which states that loss of material due to general, pitting, and crevice corrosion for penetration sleeves are managed by the applicant's ASME Section XI, Subsection IWE and 10 CFR Part 50 Appendix J Programs. The staff reviewed LRA Sections 2.3.2, 3.2, and 3.5 and confirmed that the applicant is managing aging for these components using item 3.5.1-18. The staff finds that aging management of these items using item 3.5.1-18 is equivalent to that of GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," because the ASME Section XI, Subsection IWE Program requires periodic visual inspections of the components which is the same inspection methodology as in the GALL recommended AMP and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-35, addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling in steel containment isolation piping and component internal surfaces exposed to raw water. The applicant stated that this item is not applicable because there are no steel engineered safety features systems that contain containment isolation components exposed to raw water. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include steel containment isolation piping and components internal surfaces exposed to raw water. The staff also reviewed the FSAR and confirmed that no in-scope steel containment isolation piping and components internal surfaces exposed to raw water are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-36, addresses loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion and fouling in steel heat exchanger components exposed to raw water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include steel heat exchanger components exposed to raw water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope steel heat exchanger components exposed to raw water are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-38, addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling in stainless steel containment isolation piping and component internal surfaces exposed to raw water. The applicant stated that this item is not applicable because there are no stainless steel engineered safety features systems that contain containment isolation components exposed to raw water. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include stainless steel containment isolation components exposed to raw water. The staff also reviewed the FSAR and confirmed that no in-scope stainless steel containment isolation piping and components internal surfaces exposed to raw water are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-39, addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling in stainless steel heat exchanger components exposed to raw water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include stainless steel heat exchanger components exposed to raw water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope stainless steel heat exchanger components exposed to raw water are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-40, addresses reduction of heat transfer due to fouling in stainless steel heat exchanger tubes serviced by open-cycle cooling water exposed to raw water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include stainless steel heat exchanger tubes exposed to raw water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope stainless steel heat exchanger tubes exposed to raw water are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-41, addresses copper alloy with greater than 15 percent zinc piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include copper alloy with greater than 15 percent zinc piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's FSAR did not find any evidence of copper alloy with greater than 15 percent zinc piping, piping components, and piping elements in the engineered safety features systems exposed to closed cycle cooling water. Based on its review of the LRA and FSAR, the staff confirmed that there are no in-scope, copper alloy with greater than 15 percent zinc piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-42, addresses gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include gray cast iron piping, piping components, and piping elements, exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's FSAR did not find any evidence of gray cast iron piping, piping components, and piping elements in the engineered safety features systems exposed to closed-cycle cooling water. Based on its review of the LRA and FSAR, the staff confirmed that there are no in-scope, gray cast iron piping, piping components, and piping elements exposed to soil in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-43, addresses gray cast iron piping, piping components, and piping elements exposed to soil. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include gray cast iron piping, piping components, and piping elements, exposed to soil. The staff also noted that a search of the applicant's FSAR did not find any evidence of gray cast iron piping, piping components, and piping elements in the engineered safety features systems exposed to soil. Based on its review of the LRA and FSAR, the staff confirmed that there are no in-scope, gray cast iron piping, piping components, and piping elements exposed to soil in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-44, addresses gray cast iron motor coolers exposed to treated water. The applicant stated that this item is not applicable. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include gray cast iron motor coolers exposed to treated water. The staff also noted that a search of the applicant's FSAR did not find any evidence of gray cast iron motor coolers in the engineered safety features systems exposed to treated water. Based on its review of the LRA and the FSAR, the staff confirmed that there are no in-scope, gray cast iron motor coolers exposed to treated water in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-46, addresses steel encapsulation components exposed to air with borated water leakage (internal) being managed for loss of material due to general, pitting, crevice, and boric acid corrosion. The GALL Report recommends that this aging effect be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant stated that this item is not applicable because the valve chambers (steel encapsulation components) are treated as structural commodities and included with the penetration sleeves for the purposes of an AMR. The applicant referenced LRA Table 3.5.1, item 3.5.1-18, which states that loss of material due to general, pitting, and crevice corrosion for penetration sleeves are managed by the applicant's ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs. The applicant also referenced LRA Table 3.5.1, item 3.5.1-55, which states that loss of material due to boric acid corrosion is managed by the Boric Acid Corrosion Program. The staff reviewed LRA Sections 2.3.2, 3.2, and 3.5 and confirmed that the applicant is managing aging for these components using items 3.5.1-18 and 3.5.1-55. The staff finds that aging management of these items using item 3.5.1-18 is equivalent to that of GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," because the ASME Section XI, Subsection IWE Program requires periodic visual inspections of the components which is the same inspection methodology as in the GALL recommended AMP and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2.1, item 3.2.1-47, addresses cast austenitic stainless steel piping, piping components, and piping elements exposed to treated borated water greater than 250 °C (482 °F). The GALL Report recommends the Thermal Aging Embrittlement of CASS Program to manage loss of fracture toughness due to thermal aging embrittlement for this component group. The applicant stated that this item is not applicable because CASS valves associated with ESF Systems are inside Class 1 boundaries and evaluated with RCS components. The staff evaluated the applicant's claim and found AMR results for piping components in the core flood system (LRA Table 3.2.2-2) and decay heat removal system (LRA Table 3.2.2-3) that did not indicate if they were valves. On June 2, 2010, staff issued RAI 3.2.1.47-1 and requested that the applicant provide a list of component types covered by the LRA Table 3.2.1, item 3.2.1-47 in the core flood system and decay heat removal system. Secondly, the applicant was requested to provide justification for managing loss of fracture toughness due to thermal embrittlement using the ASME Section XI, Inservice Inspection Subsections IWB, IWC, and IWD Program for Class 1 pump casings and valve bodies rather than using the Thermal Aging Embrittlement of CASS Program.

By letter dated June 21, 2010, the applicant provided a response to RAI 3.2.1.47-1 which stated that the component types covered by this AMR for CASS components in the core flood system are valves including valve bodies and bonnets. The applicant further stated that the component types covered by the AMR for CASS components in the decay heat system are also valves including valve bodies and bonnets. The staff noted that SRP-LR Table 3.1.-1, item 55 recommends that cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant greater than 250 °C (482 °F) can be managed for loss of fracture toughness due to thermal aging embrittlement by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff noted that GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," states the following:

> For pump casings and valve bodies, based on the assessment documented in the letter dated May 19, 2000, from Christopher Grimes, Nuclear Regulatory Commission (NRC), to Douglas Walters, Nuclear Energy Institute (NEI), screening for susceptibility to thermal aging is not required. The existing ASME

Section XI inspection requirements, including the alternative requirements of ASME Code Case N-481 for pump casings, are adequate for all pump casings and valve bodies.

The staff noted that consistent with the recommendations of the GALL Report, ASME Class 1 valve bodies are adequately managed for loss of fracture toughness due to thermal aging embrittlement by the existing ASME Section XI inspection requirements. Based on its review, the staff finds the applicant's response to RAI 3.2.1.47-1 and proposal to manage loss of fracture toughness with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program acceptable because consistent with GALL AMP XI.M12 and the SRP-LR, the inspections performed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program can manage loss of fracture toughness due to thermal aging embrittlement for CASS Class 1 valve bodies and bonnets. The staff's concern described in RAI 3.2.1.47-1 is resolved.

Based on its review, the staff finds that these CASS Class 1 valve bodies and bonnets are adequately managed by ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and addressed by LRA Table 3.1.1, item 3.1.1-55 and, therefore, finds the applicant's determination that LRA Table 3.2.1, item 3.2.1-47. is not applicable, acceptable.

LRA Table 3.2.1, item 3.2.1-51 addresses galvanized steel ducting exposed to indoor controlled air and states that the item is not applicable to CR-3. LRA Table 3.2.1, item 3.2.1-51, corresponds to GALL Report Table 2, item 51 which references GALL Report, Table V.F, item V.F-1 which recommends no aging effect or aging mechanism and that no AMP for this component group exposed to this environment is recommended. Therefore, the staff finds the applicant's determination of not applicable for LRA Table 3.2.1, item 3.2.1-51, equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.2.1, item 3.2.1-52 addresses glass piping elements exposed to air-indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water and states that this item is not applicable to CR-3. LRA Table 3.2.1, item 3.2.1-52, corresponds to GALL Report Table 2, item 52 which references GALL Report, Table V.F, items V.F-6, -7, -8, -9, and -10, which recommend that there are no aging effects or aging mechanisms and that no AMP for this component group exposed to this environment is recommended. Therefore, the staff finds the applicant's determination of not applicable for LRA Table 3.2.1, item 3.2.1-52, equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.2.1, item 3.2.1-54 addresses steel piping, piping components and piping elements exposed to indoor controlled air and states that this item is not applicable to CR-3. LRA Table 3.2.1, item 3.2.1-54, correspond to GALL Report Table 2, item 54 which references GALL Report, Table V.F, item V.F-16 which recommends that there is no aging effect, aging mechanism and that no aging management program for this component group exposed to this environment is recommended. Therefore, the staff finds the applicant's determination of not applicable for LRA Table 3.2.1, item 3.2.1-54 equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.2.1, item 3.2.1-55 addresses steel and stainless steel piping, piping components and piping elements exposed to concrete and states that this item is not applicable to CR-3. LRA Table 3.2.1, item 3.2.1-52, correspond to GALL Report Table 2, item 52 which references GALL Report, Table V.F, items V.F-14 and V.F-17 which recommend that there is no aging effect, aging mechanism and that no aging management program for this component group exposed to this environment is recommended. Therefore, the staff finds the applicant's determination of not applicable for LRA Table 3.2.1, item 3.2.1-55 equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.2.1, item 3.2.1-57 addresses stainless steel and copper alloy piping, piping components and piping elements exposed to air with borated water leakage and states that this item is not applicable to CR-3. LRA Table 3.2.1, item 3.2.1-52, correspond to GALL Report Table 2, item 52 which references GALL Report, Table V.F, items V.F-5 and V.F-13 which recommend that there is no aging effect, aging mechanism and that no aging management program for this component group exposed to this environment is recommended. Therefore, the staff finds the applicant's determination of not applicable for LRA Table 3.2.1, item 3.2.1-57 equivalent to the GALL Report recommendations and, therefore, acceptable.

3.2.2.1.2 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.2.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.2.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the ESF systems components and provides information concerning how it will manage the following aging effects:

- cracking
- cumulative fatigue damage
- loss of material
- loss of preload
- loss of fracture toughness
- reduction of heat transfer effectiveness

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.2.2.2. The staff's review of the applicant's further evaluation follows.

3.2.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.2.2.2.1, the applicant stated that this fatigue evaluation is a TLAA as defined in 10 CFR 54.3, and that its TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The applicant also stated that the evaluations of this TLAA are separately addressed in LRA Section 4.3.

The staff verified that in LRA Sections 4.3.1.7 and 4.3.2 the applicant provided its fatigue TLAA evaluation for components included in this section. The staff's evaluation of this TLAA, Class 1 and Non-Class 1 piping fatigue, are documented in SER Sections 4.3.1.7 and 4.3.2.

3.2.2.2.2 Loss of Material Due to Cladding Breach

LRA Section 3.2.2.2.2 addresses loss of material due cladding breach of steel with stainless steel cladding pump casing exposed to treated borated water. The applicant stated that this aging effect is not applicable because its charging pump casings are fabricated from solid stainless steel. The staff reviewed the applicant's FSAR and confirmed that the charging pumps are constructed of stainless steel.

LRA Section 3.2.2.2.2 addresses loss of material due cladding breach of steel with stainless steel cladding pump casing exposed to treated borated water. The applicant stated that this aging effect is not applicable because its charging pump casings are fabricated from solid stainless steel. The staff reviewed the applicant's FSAR and confirmed that the charging pumps are constructed of stainless steel.

The staff reviewed LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2 which states that loss of material due to cladding breach could occur for PWR steel pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks," and recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

Based on the fact that the applicant's charging pumps are stainless steel as opposed to stainless steel clad steel, the staff finds that the aging effect is not applicable.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following criteria in SRP-LR Section 3.2.2.2.3:

(1) LRA Table 3.2.1, item 3.2.1-03 refers to LRA Section 3.2.2.2.3.1 and addresses stainless steel containment isolation piping and component internal surfaces exposed to treated water which are being managed for loss of material due to pitting and crevice corrosion in their parent systems. The applicant addressed the further evaluation criteria

of the SRP-LR by stating that if loss of material due to pitting and crevice corrosion is applicable, an appropriate aging management program is credited.

The staff reviewed LRA Section 3.2.2.2.3, item 1, against the criteria described in SRP-LA Section 3.2.2.2.3, item 1 which states that loss of material could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry but that it should be augmented with a one-time inspection of select components at susceptible locations to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In its review of the LRA, the staff noted that there are no AMR results that reference Table 3.2.1, item 3.2.1-03. Instead, AMR items related to containment isolation piping and components exposed to treated water reference LRA Table 3.2.1, item 3.2.1-49 which is for stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water. LRA Table 3.2.1, item 3.2.1-49 manages the loss of material due to pitting and crevice corrosion for these components solely with the Water Chemistry Program.

By letter dated December 1, 2009, the staff issued RAI 3.2.2.2.3.1-1 requesting that the applicant provide additional information regarding why the use of the Water Chemistry Program without the One-Time Inspection Program is adequate to manage the loss of material due to pitting and crevice corrosion for stainless steel containment isolation piping. In its response dated December 30, 2009, the applicant stated that the containment spray and emergency core cooling systems are safety-related systems and, therefore, LRA Table 3.2.1, item 3.2.1-03, is not appropriate. The applicant further indicated that these components align to the GALL Report Sections V.A and V.D, which specify the use of the Water Chemistry Program and do not recommend a verification program. SRP-LR item 3.2.1-03 refers to GALL Report item V.C-4, which is for containment isolation components in non-safety related systems. The staff finds that the applicant's management of the loss of material due to pitting and crevice corrosion for containment isolation piping and component internal surfaces acceptable because the applicant's proposed aging management is consistent with the GALL Report recommendation for items V.A-27 and V.D1-30, which are appropriate for the applicant's safety-related PWR components. The staff's concern described in RAI 3.2.2.2.3.1-1 is resolved.

(2) LRA Section 3.2.2.2.3.2 addresses stainless steel piping exposed to soil affected by loss of material due to pitting and crevice corrosion. The applicant stated that this item is not applicable because the engineered safety features systems do not have any stainless steel piping exposed to soil. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features system that include stainless steel piping exposed to soil. The staff reviewed the applicant's FSAR and confirmed that no in-scope stainless steel piping exposed to soil are present in the engineered safety features system and, therefore, finds the applicant's determination acceptable.

(3) LRA Section 3.2.2.2.3.3 addresses loss of material due to pitting and crevice corrosion in BWR stainless steel and aluminum piping, stating that this aging effect is applicable to BWRs only. SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and

crevice corrosion may occur in BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The staff finds that SRP-LR Section 3.2.2.2.3, item 3 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR Section is only applicable to BWRs.

(4) LRA Table 3.2.1, item 3.2.1-06 refers to Section 3.2.2.2.3.4 and addresses stainless steel and copper alloy piping, piping components, and piping elements of the make-up and purification system exposed to lubricating oil which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the applicable components exposed to lubricating oil are in the make-up and purification system and are being managed for loss of material by the Lubricating Oil Analysis Program augmented by the One-Time Inspection Program to verify program effectiveness.

The staff reviewed LRA Section 3.2.2.2.3, item 4 against the criteria in SRP-LR Section 3.2.2.2.3, item 4 which states that loss of material due to pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the Lubricating Oil Analysis Program to manage corrosion should be verified and that a one-time inspection is an acceptable method to verify the effectiveness of the lubricating oil program.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. The staff noted that the applicant's Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking or reduction of heat transfer. The staff also noted that the applicant's One-Time Inspection Program verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. In its review of components associated with LRA Table 3.2.1, item 3.2.1-06, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general, pitting and crevice corrosion by periodically sampling the lubricating oil to maintain contaminants at acceptable limits and through a one-time inspection of select components exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

(5) LRA Table 3.2.1, item 3.2.1-07 refers to LRA Section 3.2.2.2.3.5 and addresses external surfaces of the borated water storage tank (BWST) exposed to raw water due to cracking of the perimeter seal from weathering which is being managed for loss of material from pitting and crevice corrosion by the Structures Monitoring Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the external surface of the shell of the BWST has a 1-inch gap filled with Styrofoam™ encased in concrete up to the upper dome. The applicant also stated that a caulked seal around the perimeter of the tank at the top of the encasement prevents water intrusion to the outside surface of the tank wall. The applicant further stated that

cracking of the perimeter seal of the BWST is managed by the Structures Monitoring Program to verify that unacceptable degradation is not occurring.

The staff reviewed LRA Section 3.2.2.2.3.5 against the criteria in SRP-LR Section 3.2.2.2.3 item 5 which states that loss of material from pitting and crevice corrosion could occur for partially-encased, stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The SRP-LR also states that the GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. The GALL Report states that acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.14. The staff noted that although the further evaluation section is documented through LRA Table 3.2.1, item 3.2.1-07, the BWST AMR line item is associated with Table 3.5.1, item 3.5.1-44. The staff also noted that Table 3.5.1, item 3.5.1-44 is for elastomer seals, gaskets, and moisture barriers which are being managed for loss of sealing by the Structures Monitoring Program. In its review of components associated with LRA Section 3.2.2.2.3.5, the staff finds the applicant's proposal to manage aging using LRA Table 3.5.1, item 3.5.1-44 and the Structures Monitoring Program acceptable because the program is designed to identify degraded seals and the consequences of seal degradation, and the aging effect of loss of material can only occur if the seal degrades and allows leakage of raw water.

(6) LRA Table 3.2.1, item 3.2.1-08 refers to LRA Section 3.2.2.2.3 and addresses stainless steel piping, piping components, and piping elements and tanks with internal surfaces in contact with condensation which are being managed for loss of material due to pitting and crevice corrosion by either the Inspection of Internal Miscellaneous Piping and Ducting Components Program or the Water Chemistry Program augmented by the One-Time Inspection Program. The applicant addressed the further evaluation criteria in the SRP-LR by stating that this aging effect has been predicted for surfaces prone to condensation or periodic wetting and that it did not consider the reactor building spray piping to be susceptible to condensation because it is verified to be drained, not subject to wetting by system operation, and is kept in standby at ambient conditions. The applicant also stated that it will manage this aging effect for abandoned chemical additive piping and components in the reactor building spray system that were put in lay-up with demineralized water with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant further stated that it will use the Water Chemistry Program augmented by the One-Time Inspection Program to manage this aging affect for the internal surfaces and connected piping for the borated water storage tank.

The staff reviewed LRA Section 3.2.2.2.3, item 6 against the criteria described in SRP-LR Section 3.2.2.2.3, item 6 which states that loss of material could occur for stainless steel piping, piping component, piping elements, and tanks exposed to internal condensation. The GALL Report, under items V.D2-35, V.A-26, and V.D1-29, recommends that a plant-specific AMP be evaluated. The SRP-LR also states that acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In its review of components associated with Table 3.2.1, item 3.2.1-08, the staff was unclear how the applicant verified that the components in the reactor building spray system were drained. By letter dated December 1, 2009, the staff issued RAI 3.2.2.2.3.6-1 requesting that the applicant provide additional information regarding how the reactor building spray piping inside containment is ensured to be drained, and how moisture is prevented from passing through seals into the spray piping. In its response dated December 30, 2009, the applicant stated that the spray system design isolates the reactor building spray headers from the reactor building spray pumps by isolation valves, which are tested quarterly and that the system is verified drained by opening local drain valves. The applicant also stated that the portion of piping inside containment is not connected to any outside water supply and that the piping is at ambient temperature so that wetting through condensation will not occur. The staff finds the applicant's response acceptable because it has taken appropriate precautions to ensure the reactor building spray piping is drained. The staff's concern described in RAI 3.2.2.2.3.6-1 is resolved.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, Water Chemistry, and One-Time Inspection programs are documented in SER Sections 3.0.3.1.12, 3.0.3.1.2, and 3.0.3.1.9, respectively. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs visual examinations of the internal surfaces of piping and ducting components which can detect loss of material. The applicant also stated that the Water Chemistry Program monitors and controls the contaminants in the water to minimize aging effects, including loss of material. The applicant further stated that the One-Time Inspection Program is credited to verify the effectiveness of the Water Chemistry Program. The staff finds the applicant's proposal to manage loss of material due to pitting and crevice corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Water Chemistry Program augmented by the One-Time Inspection Program acceptable because the components not exposed to water are inspected for loss of material, and the components exposed to condensation are exposed to water that is monitored for contaminants and effectiveness of the chemistry control methods.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3 criteria. For those items that apply to LRA Section 3.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.2.2.2.4 against the following criteria in SRP-LR Section 3.2.2.2.4:

(1) Table 3.2.1, item 3.2.1-09, refers to LRA Section 3.2.2.2.4.1 and addresses steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil in the high pressure injection and the make-up and purification systems which are being managed for reduction of heat transfer due to fouling by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Lubricating Oil Analysis Program maintains

contaminants within limits to preserve an environment that is not conducive to reduction of heat transfer, and that the One-Time Inspection Program verifies that unacceptable degradation of the applicable components is not occurring.

The staff reviewed LRA Section 3.2.2.2.4.1 against the criteria in SRP-LR Section 3.2.2.2.4, item 1, which states that reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on monitoring and controlling lubricating oil chemistry to mitigate reduction of heat transfer due to fouling. However, as further noted in the SRP-LR, control of lubricating oil contaminants may not always be fully effective in precluding fouling; therefore, the effectiveness of lubricating oil control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program, and notes that a one-time inspection of selected components at susceptible locations is an acceptable method for determining that this aging effect is not occurring.

The staff's evaluation of the applicant's Lubricating Oil Analysis and One-Time Inspection programs is documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.2.1, item 3.2.1-09, the staff finds the applicant's proposal to manage aging using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because lubricating oil contaminants will be monitored and controlled by the Lubricating Oil Analysis program and appropriate NDE methods including visual, ultrasonic, and surface examinations will be used to detect aging effects by the One-Time Inspection program.

(2) Table 3.2.1, item 3.2.1-10, refers to LRA Section 3.2.2.2.4.2 and addresses stainless steel heat exchanger tubes exposed to treated water in the decay heat removal, liquid sampling, and make-up and purification systems which are being managed for reduction of heat transfer due to fouling by the Water Chemistry and One-time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Water Chemistry Program controls water chemistry for mitigation of heat transfer reduction due to fouling, and that the One-Time Inspection Program verifies that unacceptable degradation of the applicable components is not occurring.

The staff reviewed LRA Section 3.2.2.2.4.2 against the criteria in SRP-LR Section 3.2.2.2.4, item 2, which states that reduction of heat transfer due to fouling may occur for stainless steel heat exchanger tubes exposed to treated water, and that management of this aging effect relies on water chemistry control. The SRP-LR also states that since control of water chemistry may have been inadequate, the GALL Report recommends that the effectiveness of the chemistry control program be verified to ensure that heat transfer reduction due to fouling is not occurring. The GALL Report notes that a one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring, and that components' intended functions will be maintained during the period of extended operation.

The staff's evaluation of the applicant's Water Chemistry Program and One-time Inspection Program is documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.2.1, item 3.2.1-10, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and One-Time Inspection Program acceptable because the Water Chemistry Program will monitor and control water chemistry to keep contaminant levels below specified limits, and that the effectiveness of the program is verified through the

One-Time Inspection Program, which selects appropriate NDE methods for detecting aging effects.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4 criteria. For those items that apply to LRA Section 3.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

SRP-LR Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components of the BWR standby gas treatment system ductwork and filters exposed to air-indoor uncontrolled. The staff finds that SRP-LR Section 3.2.2.2.5 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is applicable to components within the standby gas treatment system in BWRs.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.5 criteria do not apply.

3.2.2.2.6 Loss of Material Due to Erosion

LRA Table 3.2.1, item 3.2.1-12, refers to LRA Section 3.2.2.2.6 and addresses the loss of material for stainless steel high pressure injection make-up (charging) pump miniflow recirculation orifice plates exposed to treated borated water, which are being managed for loss of material due to erosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6, which states that loss of material due to erosion could occur in the stainless steel high pressure safety injection pump miniflow recirculation orifice exposed to treated borated water and the aging effect should be managed by a plant-specific program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the above program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in the loss of a component's intended function.

The staff noted that LRA Section B.2.23, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, credits work order tasks that provide opportunities for the visual inspection of internal surfaces of piping and ducting components. By letter dated July 8, 2010, the staff issued RAI 3.2.2.2.6-1 requesting that the applicant describe the work order task(s) that provide the opportunity to visually inspect the orifices to ensure that material loss due to erosion will be adequately managed.

In its response dated August 9, 2010, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will ensure that where no existing activity can be identified that adequately manages the effects of aging, additional activities will be developed to satisfy program requirements. The applicant also stated that for the high pressure injection pump miniflow recirculation orifices, there are no existing activities that can be credited, and therefore, a new visual inspection activity will be implemented in accordance with the program to ensure that the intended function of these components is maintained throughout the period of extended operation.

The staff finds the applicant's response and proposal to manage aging acceptable because (a) the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will ensure that where no existing activity can be identified that adequately manages the effects of aging, additional activities will be developed to satisfy program requirements, (b) new periodic visual inspections of the high pressure injection pump miniflow recirculation orifices will be implemented in accordance with the program, and (c) visual inspections are capable of detecting loss of material due to erosion. The staff's concern described in RAI 3.2.2.2.6-1 is resolved.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.2.2.2.6 criteria. For those items that apply to LRA Section 3.2.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).Loss of Material Due to General Corrosion and Fouling

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

LRA Section 3.2.2.2.7 addresses loss of material due to general corrosion and fouling on steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air-indoor uncontrolled, stating that this aging effect is not applicable to CR-3, that it is applicable to BWRs only. SRP-LR Section 3.2.2.2.7 states that loss of material due to general corrosion and fouling may occur on steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air-indoor uncontrolled and may cause plugging of the spray nozzles and flow orifices. The staff finds that SRP-LR Section 3.2.2.2.7 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to drywell and suppression chamber spray systems in BWRs.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.7 criteria do not apply.

3.2.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.8 against the following criteria in SRP-LR Section 3.2.2.2.8:

(1) LRA Section 3.2.2.2.8.1 addresses loss of material due to general, pitting, and crevice corrosion in BWR steel piping, piping components, and piping elements exposed to treated water, stating that this aging effect is not applicable to CR-3, that it is applicable to BWRs only. SRP-LR Section 3.2.2.2.8, item 1, states that loss of material due to general, pitting, and crevice corrosion may occur in BWR steel piping, piping components, and piping elements exposed to treated water. The staff finds that SRP-LR Section 3.2.2.2.8, item 1, is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to steel piping, piping components, and piping elements exposed to treated water in BWRs.

(2) LRA Table 3.2.1, item 3.2.1-15, refers to LRA Section 3.2.2.2.8.2 and addresses steel containment isolation piping, piping components, and piping elements internal surfaces

exposed to treated water being managed for loss of material due to general, pitting, and crevice corrosion. The applicant addressed the further evaluation criteria of the SRP-LR by stating that steel containment isolation piping is evaluated within their parent systems and that if loss of material is applicable, an appropriate AMP is credited.

The staff reviewed LRA Section 3.2.2.2.8, item 2, against the criteria described in SRP-LR Section 3.2.2.2.8, item 2, which states that the loss of material due to general, pitting and crevice corrosion is possible for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the AMP relies on water chemistry control, but that this should be augmented with a one-time inspection of selected components at susceptible locations to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff reviewed all AMR results in the LRA for steel piping, piping components, and piping elements exposed to treated water and noted that the applicant referenced several different line items, all of which used the Water Chemistry Program augmented with the One-Time Inspection Program to manage the effects of loss of material. The staff reviewed the Water Chemistry and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant indicated that these programs provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits as defined by the EPRI water chemistry guidelines and will perform one-time inspections of component subjected to exposed to treated water to detect material loss. The staff finds the applicant's proposed management of loss of material due to general, pitting, and crevice corrosion acceptable because the applicant's programs are consistent with the acceptance criteria in SPR-LR Section 3.2.2.2.8, item 2.

(3) Table 3.2.1, item 3.2.1-16, refers to LRA Section 3.2.2.2.8, item 3, and addresses steel piping, piping components, and piping elements of the make up and purification system exposed to lubricating oil which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis and the One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material of these components is managed using the Lubricating Oil Analysis Program augmented by the One-Time Inspection Program to verify program effectiveness.

The staff reviewed LRA Section 3.2.2.2.8.3 against the criteria in SRP-LR Section 3.2.2.2.8, item 3, which states that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.2.1, item 3.2.1-16, the staff finds the applicant's proposal to use the Lubricating Oil Analysis and

One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general pitting and crevice corrosion by periodic sampling of lubricating oil to maintain contaminants at acceptable limits, and through a one-time inspection of components exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Section 3.2.2.2.9 addresses steel piping, piping components, and piping elements buried in soil regardless of the presence of pipe coating or wrapping affected by loss of material due to general, pitting, crevice, and MIC. The applicant stated that this item is not applicable because there are no steel piping, piping components, and piping elements buried in soil in the engineered safety features systems. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the engineered safety features systems that include steel piping, piping components, and piping elements buried in soil regardless of the presence of pipe coating or wrapping. The staff reviewed the applicant's FSAR and confirmed that no in-scope steel piping, piping components, and piping elements buried in soil regardless of the presence of pipe coating or wrapping are present in the engineered safety features systems and, therefore, finds the applicant's determination acceptable.

3.2.2.2.9 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.2.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-3, via notes F through J, the applicant indicated which combinations of component type, material, environment, and AERM do not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.2.2.3.1 Reactor Building Spray System-Summary of Aging Management Review-LRA Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the reactor building spray system component groups.

In LRA Tables 3.2.2-1 and 3.2.2-3, the applicant stated that the carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (outside) are being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program. The AMR line items cite generic note J.

The staff evaluated the AMR items in comparison with the GALL Report. In its review, the staff noted that GALL Report, Tables V.A through V.F for the engineered safety features describe one AMR item for the loss of preload of bolting under item V.E-5. In comparison with the applicant's AMR items exposed to air-outdoor, the staff noted that GALL Report item V.E-5 addresses the loss of preload of steel bolting exposed to air-indoor uncontrolled (external) and the GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage the aging effect. The staff also noted that the GALL Report recommends no further evaluation for the item.

The staff reviewed the applicant's Bolting Integrity Program, and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds the applicant's currently proposed AMP acceptable because the applicant's program manages loss of preload through the proper selection of bolting and gasket materials, preload control, and compliance with the bolting installation guidance recommended in the GALL Report, and the GALL Report recommends the Bolting Integrity Program to manage the loss of preload of the steel bolting exposed to uncontrolled indoor air, which is an environment similar to that of the AMR items.

In LRA Table 3.2.2-1, the applicant stated that for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment there is no aging effect and no AMP is proposed. The AMR line item cites generic note J.

The staff finds the applicant's proposal acceptable because the GALL Report, items III.B1.1-6, V.F-2, and Vii.J-1 recommend no aging effect requiring management for aluminum piping, piping components, and piping elements in a controlled indoor air environment.

In LRA Table 3.2.2-1, the applicant stated that stainless steel piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The applicant also cited plant-specific note 201, indicating that a raw water environment has been assumed for this abandoned equipment associated with the sodium hydroxide tanks.

The staff reviewed all the AMR result lines in the GALL Report where the component and material is stainless steel piping, piping components, and piping elements exposed to raw water and noted that there are several entries for this component, material, and environment where the aging effect is loss of material due to microbiologically influenced corrosion. The GALL Report recommends GALL AMP XI.M20, “Open-Cycle Cooling Water System Program” to manage the effects of aging for this component, material, and environment combination. The staff notes that the “Open-Cycle Cooling Water System Program” uses surveillance testing, inspections, maintenance, and walkdowns to manage the effects of exposure to open-cycle cooling water on safety-related SSCs. Since the components described in this case have been abandoned, use of the “Open-Cycle Cooling Water System Program” would not be appropriate.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and its evaluation is documented in SER Section 3.0.3.1.12. The staff notes that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic visual inspections to ensure that loss of material is adequately managed. The staff finds the applicant’s proposed program acceptable to manage microbiologically-influenced corrosion of stainless steel piping, piping components, piping elements, and tanks exposed to raw water because the components are abandoned and visual inspection is capable of detecting loss of material.

In LRA Tables 3.2.2-1, 3.2.2-3, 3.3.2-23, 3.3.2-25 3.3.2-33, 3.3.2-38, and 3.3.2-50, the applicant stated that stainless steel containment isolation piping and components, piping, piping components, piping elements, tanks, borated water storage tank and diesel exhaust silencers exposed to outdoor air are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program. The applicant cited generic note J.

The staff reviewed all the AMR result lines in the GALL Report where the component and material is stainless steel piping, piping components, piping elements and tanks exposed to outdoor air and confirmed that there are no entries for this component, material, and environment where the aging effect is loss of material. The staff noted that the GALL Report, Section IX.D, states that outdoor air is air that contains moisture (condensation) and other possible contaminants, and that moist air environments can cause loss of material due to corrosion.

The staff reviewed the applicant's External Surfaces Monitoring Program, and its evaluation is documented in SER Section 3.0.3.2.11. The staff finds the applicant’s proposed AMP acceptable because it performs periodic visual inspections of stainless steel components which is an appropriate technique to detect loss of material due to crevice or pitting corrosion.

By letter dated November 12, 2010, the applicant amended the LRA and Tables 3.2.2-1 and 3.2.2-2, to include AMRs for copper and copper alloy piping, piping components and piping elements exposed to dried air (inside) which are being managed for the loss of material by the Compressed Air Monitoring Program. The AMR items cite generic note J. The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material and environmental combination because the applicant has recognized the possibility of moisture and/or condensation in systems which typically only contain dried air.

The staff’s evaluation of the applicant’s Compressed Air Monitoring Program is documented in SER Section 3.0.3.1.11. The staff noted that the applicant’s Compressed Air Monitoring Program is identified as consistent with no enhancements or exceptions with the GALL Report Compressed Air Monitoring Program. The staff finds the applicant’s proposal to manage aging using the Compressed Air Monitoring Program acceptable because copper and copper alloy piping, piping components and piping elements in a dried air environment (with the potential for condensation) would have the same aging effect as the steel compressed air system piping, piping components and piping elements exposed to condensation described in item A-26 in the GALL Report, which recognizes loss of material as an aging effect to be managed by the Compressed Air Monitoring Program. On the basis that the LRA components are similar to other GALL Report items for the material and environment, the staff confirmed that the potential loss of material can be effectively managed by the Compressed Air Monitoring Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Core Flood System-Summary of Aging Management Review-LRA Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the core flood system component groups.

In LRA Table 3.2.2-2, the applicant stated that for nickel-alloy core flood tanks exposed to treated water are being managed for cracking due to stress corrosion cracking by its Nickel-Alloy Commitment (Commitment No. 2). The staff noted that Commitment No. 2 states:

> In accordance with the guidance of NUREG-1801, regarding activities for managing the aging of nickel-alloy and nickel-clad components susceptible to primary water stress corrosion cracking, CR-3 will comply with applicable NRC Orders and will implement: (1) applicable Bulletins and Generic Letters, and (2) staff-accepted industry guidelines.

The AMR line items cite generic note J and plant-specific note 205, which states this item addresses nickel-alloy nozzles and welds associated with the core flood tanks.

The staff reviewed LRA Section A.1.1 and Commitment No. 2. The staff noted that GALL Table V.D1 identifies cracking due to stress corrosion cracking as an aging effect of concern for stainless steel piping managed by the Water Chemistry Program. For other systems in the LRA and GALL Report, management of stress corrosion cracking in nickel-alloy components is credited by the Nickel-Alloy Commitment and various AMPs including the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program.

By letter dated December 1, 2009, the staff issued RAI 3.2.2.2.2-1 requesting that the applicant provide additional information justifying how the Nickel-Alloy Commitment provides adequate aging management for the aging effect of stress corrosion cracking in nickel-alloy core flood tanks exposed to treated water.

In its response dated December 30, 2009, the applicant stated that this AMR line item credits the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in addition to the Nickel-Alloy Commitment. The applicant amended its LRA to reference GALL Report item IV.C2-21 and Table 1, item 3.1.1-31, and notes C and 205.

Based on its review, the staff finds the applicant's response to RAI 3.2.2.2-1 acceptable because the applicant amended its LRA to credit its Water Chemistry Program, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and the Nickel-Alloy Commitment, consistent with GALL AMR item IV.C2-21, to manage cracking due to stress corrosion cracking for the nickel-alloy core flood tanks. The staff's concern described in RAI 3.2.2.2-1 is resolved.

In LRA Table 3.2.2-2, the applicant further stated that nickel-alloy core flood tanks exposed to treated water are being managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program. The AMR line items cite generic note J. The staff noted that GALL Table IV.B4 (item IV.B4-38) identifies loss of material due to pitting and crevice corrosion as an aging effect of concern for nickel alloy. The GALL Report recommends the Water Chemistry Program.

The staff's review of the Water Chemistry Program, and its evaluation is documented in SER Section 3.0.3.1.2. The staff finds the applicant's currently-proposed AMP acceptable because it requires periodic monitoring and control water chemistry for impurities (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion and cracking. The staff's review of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, and its evaluation is documented in SER Section 3.0.3.1.1. The staff finds the applicant's proposed AMP acceptable because it performs periodic volumetric, surface, and/or visual examination which are capable of detecting cracking due to stress corrosion cracking. The staff finds the applicant's Commitment No. 2 acceptable because it is consistent with the recommendations of the GALL Report for nickel-alloy components to comply with applicable NRC Orders and implement: (1) applicable Bulletins and GLs, and (2) staff-accepted industry guidelines.

LRA Tables 3.2.2-2 and 3.2.2-3 contain items addressing piping insulation exposed to indoor air uncontrolled. The AMR line items cite generic note J. The applicant further proposes that this combination of environment and material is not subject to aging and that no aging management program is required.

In its review of these items, the staff noted that, depending on the application, piping insulation may be fabricated from many materials. These materials commonly include polymeric foams, inorganic fibers, and solid ceramics. The staff also noted that the applicant did not state the type of insulation which was being used, the material of the pipe over which it was being applied or the range of temperatures expected at the interface between the pipe and the insulation. The staff further noted that some types of insulation (e.g., polymeric foams) are subject to aging due to exposure to ultraviolet light and may require aging management. Finally, the staff noted that the combined use of some forms of insulation and piping materials in some environments, (e.g., chloride containing insulation over stainless steel pipe in humid environments) may create additional aging effects in the piping material.

By letter dated December 1, 2009, the staff issued RAI 3.2.2.3-1 requesting that the applicant provide sufficient information concerning the type of insulation being used; the type of pipe over which it will be applied; the compatibility between the insulation and the pipe; and whether the presence of condensation or other moisture is possible to allow the staff to conclude whether the insulation is subject to aging or whether the use of the insulation will result in unexpected aging of the pipe material.

In its response dated December 30, 2009, the applicant stated that insulation materials used at the station include mineral fiber, calcium silicate, fiberglass, elastomeric foam, glass wool and stainless steel reflective jacketing, and based upon an operating experience review, for an indoor air uncontrolled environment, there are no aging effects requiring management. The applicant also stated that prevention of condensation is addressed by insulation specifications including installing an appropriate thickness of the material and insulating pipe supports on piping systems where the system temperature is below ambient air temperatures. The applicant further stated that each batch of insulation installed in the reactor building was tested for chlorides, sodium and silicate. The applicant stated that a review of operating experience for all of the insulation material types confirmed that there are no aging effects requiring management.

Based on its review, the staff finds the applicant's response acceptable because all of the insulation materials are not susceptible to aging with the exception of elastomeric foam, but given its jacketing, the elastomeric foam will not be exposed to high levels of ultraviolet light and therefore there is no AERM for this material. Specifications controlled insulation installation to minimize the potential of condensation being formed between the insulation and pipe material. Even given the presence of condensation leaching through the insulation or occurring on the external surfaces of the component, testing was conducted on the insulation material to ensure that leachable elements would not cause aging effects such as cracking of the component.

By letter dated November 12, 2010, the applicant amended the LRA to include copper and copper alloy piping, piping components, piping elements, exposed to a dried air environment, being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Decay Heat Removal System-Summary of Aging Management Review-
LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the decay heat removal system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (outside) managed by the Bolting Integrity Program for loss of preload due to thermal effects, gasket creep, and self-loosening, with generic note J, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for piping insulation exposed to uncontrolled indoor air with no aging effects, with generic note J, is documented in SER Section 3.2.2.3.2.

The staff's evaluation of stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air, being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the ESF systems components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of:

- air handling ventilation and cooling system
- reactor building recirculation system
- reactor building miscellaneous ventilation system
- reactor building purge system
- auxiliary building supply system
- fuel handling area supply system
- decay heat closed-cycle pump cooling system
- spent fuel coolant pump cooling system
- spent fuel pit supply system
- auxiliary building exhaust system
- control complex ventilation system
- emergency diesel generator air handling system
- miscellaneous area heating, ventilation, and air conditioning (HVAC) system
- turbine building ventilation system
- penetration cooling system
- emergency feedwater initiation and control (EFIC) room HVAC system
- Appendix R control complex dedicated cooling supply system

- emergency feedwater pump building ventilation system
- chemical addition system
- liquid sampling system
- post-accident liquid sampling system
- control complex chilled water system
- Appendix R chilled water system
- industrial cooling system
- circulating water system
- emergency feedwater pump No. 3 (EFP-3) diesel air starting system
- decay heat closed-cycle cooling system
- fuel oil system
- jacket coolant system
- diesel generator lube oil system
- domestic water system
- demineralized water system
- emergency diesel generator system
- floor drains system
- fuel handling system
- fire protection system
- hydrogen supply system
- instrument air system
- reactor coolant pump lube oil collection system
- leak rate test system
- miscellaneous drains system
- makeup and purification system
- miscellaneous mechanical and structures system
- nitrogen supply system

- penetration cooling auxiliary system
- reactor building airlock system
- roof drains system
- radiation monitoring system
- nuclear service and decay heat sea water system
- station air system
- secondary services closed-cycle cooling water system
- station drains system
- spent fuel cooling system
- nuclear services closed-cycle cooling system
- waste disposal system
- radioactive gas waste disposal system
- radioactive liquid waste disposal system
- reactor coolant and miscellaneous waste evaporator system
- waste gas sampling system
- waste sampling system
- post-accident containment atmospheric sampling

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, "Summary of AMPs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.3.2.1.

The staff also reviewed AMRs the applicant claimed are consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.3.2.2 acceptance criteria. The staff's review is documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material and environment combinations specified. The staff's evaluations are documented in SER Section 3.3.2.3.

For SSCs, which the applicant claimed are not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.3-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.3 and addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel crane structural girders exposed to air – indoor uncontrolled (external) (3.3.1-1)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See SRP-LR Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	Not applicable	Not applicable (See SER Section 3.3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air – indoor uncontrolled, treated borated water, or treated water (3.3.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.3.2.2.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-3)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.2)
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 60 °C (>140 °F) (3.3.1-4)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.3(1))
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60 °C (>140 °F) (3.3.1-5)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.3(2))
Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (See SER Section 3.3.2.2.3(3))
Stainless steel non-regenerative heat exchanger components exposed to treated borated water > 60 °C (>140 °F) (3.3.1-7)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water and eddy current testing of tubes.	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.4(1))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel regenerative heat exchanger components exposed to treated borated water > 60 °C (>140 °F) (3.3.1-8)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.4(2))
Stainless steel high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	Yes	Water Chemistry and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.4(3))
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-10)	Cracking due to SCC and cyclic loading	Bolting Integrity. The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.4(4))
Elastomer seals and components exposed to air – indoor uncontrolled (internal/external) (3.3.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	External Surfaces Monitoring Program and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (See SER Section 3.3.2.2.5(1))
Elastomer lining exposed to treated water or treated borated water (3.3.1-12)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.5(2))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water (3.3.1-13)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant-specific AMP is to be evaluated.	Yes	Fuel Pool Rack Neutron Absorber Monitoring Program	Consistent with GALL Report (See SER Section 3.3.2.2.6)
Steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-14)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.7(1))
Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.7(1))
Steel reactor coolant pump oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.7(1))
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-17)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.7(2))
Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-18)	Loss of material and general (steel only), pitting, and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (See SER Section 3.3.2.2.7(3))
Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil (3.3.1-19)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	 Buried Piping and Tanks Inspection Program	 Consistent with GALL Report (See SER Section 3.3.2.2.8)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, piping elements, and tanks exposed to fuel oil (3.3.1-20)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.9(1))
Steel heat exchanger components exposed to lubricating oil (3.3.1-21)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.9(2))
Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water (3.3.1-22)	Loss of material due to pitting and crevice corrosion (only for steel after lining or cladding degradation)	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.10(1))
Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.10(2))
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.10(2))
Copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external) (3.3.1-25)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.10(3))
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.3.1-26)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.10(4))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel HVAC ducting and aluminum HVAC piping, piping components, and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (See SER Section 3.3.2.2.10(5))
Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-28)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.10(6))
Stainless steel piping, piping components, and piping elements exposed to soil (3.3.1-29)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.10(7))
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution (3.3.1-30)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.10(8))
Copper alloy piping, piping components, and piping elements exposed to treated water (3.3.1-31)	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.11)
Stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.12(1))
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.3.2.2.12(2))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomer seals and components exposed to air – indoor uncontrolled (internal or external) (3.3.1-34)	Loss of material due to wear	A plant-specific AMP is to be evaluated.	Yes	External Surfaces Monitoring Program and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report (See SER Section 3.3.2.2.13)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.3.2.2.14)
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water (3.3.1-36)	Reduction of neutron-absorbing capacity due to Boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60 °C (>140 °F) (3.3.1-37)	Cracking due to SCC and IGSCC	BWR Reactor Water Cleanup System	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60 °C (>140 °F) (3.3.1-38)	Cracking due to SCC	BWR SCC and Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)
Stainless steel BWR spent fuel storage racks exposed to treated water > 60 °C (>140 °F) (3.3.1-39)	Cracking due to SCC	Water Chemistry	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel tanks in diesel fuel oil system exposed to air – outdoor (external) (3.3.1-40)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading and SCC	Bolting Integrity	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel closure bolting exposed to air with steam or water leakage (3.3.1-42)	Loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Steel bolting and closure bolting exposed to air – indoor uncontrolled (external) or air – outdoor (external) (3.3.1-43)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Steel compressed air system closure bolting exposed to condensation (3.3.1-44)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Steel closure bolting exposed to air – indoor uncontrolled (external) (3.3.1-45)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water > 60 °C (>140 °F) (3.3.1-46)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed-cycle cooling water (3.3.1-47)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed-cycle cooling water (3.3.1-48)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water (3.3.1-49)	Loss of material due to microbiologically-influenced corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to PWRs (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water (3.3.1-50)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.3.1-51)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water (3.3.1-52)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-53)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation (3.3.1-54)	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel ducting closure bolting exposed to air – indoor uncontrolled (external) (3.3.1-55)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report
Steel HVAC ducting and components external surfaces exposed to air – indoor uncontrolled (external) (3.3.1-56)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report
Steel piping and components external surfaces exposed to air – indoor uncontrolled (external) (3.3.1-57)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel external surfaces exposed to air – indoor uncontrolled (external), air – outdoor (external), and condensation (external) (3.3.1-58)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report
Steel heat exchanger components exposed to air – indoor uncontrolled (external) or air – outdoor (external) (3.3.1-59)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to air – outdoor (external) (3.3.1-60)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomer fire barrier penetration seals exposed to air – outdoor or air – indoor uncontrolled (3.3.1-61)	Increased hardness, shrinkage, and loss of strength due to weathering	Fire Protection	No	Fire Protection Program	Consistent with GALL Report
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-62)	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel fire-rated doors exposed to air – outdoor or air – indoor uncontrolled (3.3.1-63)	Loss of material due to wear	Fire Protection	No	Fire Protection Program and Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.3.2.1.2)
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-64)	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Fire Protection Program and Fuel Oil Chemistry Program	Consistent with GALL Report
Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – indoor uncontrolled (3.3.1-65)	Concrete cracking and spalling due to aggressive chemical attack and reaction with aggregates	Fire Protection and Structures Monitoring	No	Fire Protection Program, Structures Monitoring Program, and ASME Section XI, Subsection IWL Program	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – outdoor (3.3.1-66)	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring	No	Fire Protection Program, Structures Monitoring Program, and ASME Section XI, Subsection IWL Program	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – outdoor or air – indoor uncontrolled (3.3.1-67)	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring	No	Fire Protection Program, Structures Monitoring Program, and ASME Section XI, Subsection IWL Program	Consistent with GALL Report (See SER Section 3.3.2.1.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and microbiologically influenced-corrosion and fouling	Fire Water System	No	Fire Water System Program	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-69)	Loss of material due to pitting and crevice corrosion and fouling	Fire Water System	No	Fire Water System Program	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling	Fire Water System	No	Fire Water System Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-71)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report
Steel HVAC ducting and components internal surfaces exposed to condensation (internal) (3.3.1-72)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically-influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report
Steel crane structural girders in load handling system exposed to air – indoor uncontrolled (external) (3.3.1-73)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Inspection of Overhead Heavy Load and Light Load Handling Systems Program	Consistent with GALL Report
Steel cranes and rails exposed to air – indoor uncontrolled (external) (3.3.1-74)	Loss of material due to wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Inspection of Overhead Heavy Load and Light Load Handling Systems Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomer seals and components exposed to raw water (3.3.1-75)	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Steel piping, piping components, and piping elements (without lining or coating or with degraded lining or coating) exposed to raw water (3.3.1-76)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, fouling, and lining or coating degradation	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel, nickel-alloy, and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-78)	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-79)	Loss of material due to pitting and crevice corrosion and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-80)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced-corrosion and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel and copper alloy heat exchanger tubes exposed to raw water (3.3.1-83)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System Program	Consistent with GALL Report
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed-cycle cooling water (3.3.1-84)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials Program and Open-Cycle Cooling Water System Program	Consistent with GALL Report (see SER Section 3.3.2.1.4)
Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water (3.3.1-85)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials Program and Open-Cycle Cooling Water System Program	Consistent with GALL Report (see SER Section 3.3.2.1.4)
Structural steel (new fuel storage rack assembly) exposed to air – indoor uncontrolled (external) (3.3.1-86)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring	No	Structures Monitoring Program	Consistent with GALL Report
Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water (3.3.1-87)	Reduction of neutron-absorbing capacity due to Boraflex degradation	Boraflex Monitoring	No	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Aluminum and copper alloy > 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-88)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Steel bolting and external surfaces exposed to air with borated water leakage (3.3.1-89)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Stainless steel and steel with stainless steel cladding piping, piping components, piping elements, tanks, and fuel storage racks exposed to treated borated water > 60 °C (>140 °F) (3.3.1-90)	Cracking due to SCC	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report
Stainless steel and steel with stainless steel cladding piping, piping components, and piping elements exposed to treated borated water (3.3.1-91)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report
Galvanized steel piping, piping components, and piping elements exposed to air – indoor uncontrolled (3.3.1-92)	None	None	NA	NA	Consistent with GALL Report
Glass piping elements exposed to air – indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water (3.3.1-93)	None	None	NA	NA	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external) (3.3.1-94)	None	None	NA	NA	Consistent with GALL Report
Steel and aluminum piping, piping components, and piping elements exposed to air – indoor controlled (external) (3.3.1-95)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	NA	NA	Consistent with GALL Report
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	NA	Not applicable	Not applicable to CR-3 (see SER Section 3.3.2.1.1)
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-99)	None	None	NA	NA	Consistent with GALL Report

The staff's review of the auxiliary systems component groups followed any one of several approaches. One approach, documented in SER Section 3.3.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.3.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER

Section 3.3.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the auxiliary systems components is documented in SER Section 3.0.3.

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Aboveground Steel Tanks Program
- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Buried Piping and Tanks Inspection Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Fire Protection Program
- Fire Water System Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Selective Leaching Program
- Structures Monitoring Program
- Water Chemistry Program

LRA Tables 3.3.2-1 through 3.3.2-61 summarize AMRs for the auxiliary systems components and indicate AMRs that claim to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMR's that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the auxiliary systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. The staff's evaluation follows.

LRA Table 3.3.2-38, "Aging Management Evaluation for Instrument Air Systems," describes the instrument air dryers as stainless steel with an internal environment of dried air. During the material/environment verification audit walkdown completed during the onsite audit, the staff noticed that the instrument air dryers appear to be carbon steel rather than stainless steel as described in LRA Table 3.3.2-38. Also, the internal environment of the dryers, in accordance with the vendor manual, contains alumina desiccant. Further review of the applicable drawings and vendor information did not clarify the type of information for this component. Therefore, by letter dated September 11, 2009, the staff issued RAI 3.3.2-38-1 requesting that the applicant provide the documentation to show that the instrument air dryer's material is stainless steel and confirm the internal environment or correct the material and environment descriptions in LRA Table 3.3.2-38.

By letter dated October 13, 2009, the applicant responded to RAI 3.3.2-38-1 by stating that the instrument air dryers are constructed of carbon steel, stainless steel, and copper alloys and have an internal environment of dried air and contain desiccant.

The staff finds the applicant's response acceptable because the applicant verified that the component and environment are addressed in the LRA. Therefore, the staff's concern addressed in RAI 3.3.2-38-1 is resolved.

3.3.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.3.1, item 3.3.1-36, addresses reduction of neutron-absorbing capacity due to Boraflex degradation in Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water. The applicant stated that this line item is not applicable because its spent fuel storage racks do not use Boraflex neutron-absorbing sheets. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water are present in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, items 3.3.1-37, 3.3.1-38, 3.3.1-39, and 3.3.1-49 discuss the applicant's determination that these line items are applicable only to BWRs. The staff verified that these line items do not apply because CR-3 is a PWR design. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR items 3.3.1-37, 3.3.1-38, 3.3.1-39, and 3.3.1-49 are not applicable.

LRA Table 3.3.1, item 3.3.1-40 addresses loss of material due to general, pitting, and crevice corrosion in steel tanks in diesel fuel oil systems exposed to outdoor air (external). The applicant stated that this line item is not applicable because its fuel oil storage tanks are either buried or inside enclosed buildings. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel tanks in diesel fuel oil systems exposed to outdoor air (external). The staff also reviewed the applicant's information in the FSAR and confirmed that no in-scope steel tanks in diesel fuel oil systems exposed to outdoor air (external) are present in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, item 3.3.1-41 addresses high-strength steel closure bolting exposed to air with steam or water leakage in the auxiliary systems. The applicant stated that this item is not applicable because there is no high-strength closure bolting in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff reviewed the applicant's FSAR and confirmed that no in-scope high-strength steel closure bolting exposed to air with steam or water leakage is present in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, line items 53 and 54 address steel and stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends use of GALL AMP XI.M24, "Compressed Air Monitoring Program," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that these line items are not applicable because CR-3 uses the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage corrosion of internal surfaces of compressed air systems that might be subject to internal condensation. The staff reviewed LRA 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the compressed air system that include stainless steel and steel piping, piping components, and piping elements exposed to internal condensation. The staff noted that although the LRA does not have any AMR results for compressed air systems subject to internal condensation, the LRA indicates that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited with managing this material, environment, and aging effect combination if it occurs. The staff noted that this LRA note appears to be in conflict with the lack of AMR line items in the LRA. Furthermore, the staff notes that the recommended GALL AMP XI.M24, "Compressed Air Monitoring Program" includes additional preventive maintenance activities which may also be applicable but are not currently being credited by the applicant for license renewal.

By letter dated June 2, 2010, the NRC issued RAI 3.31-53.1 which requested that the applicant clarify whether there are compressed air system components exposed to condensation at CR-3 and how the aging effects on piping and valves within the compressed air system that are exposed to condensation will be managed for loss of material and other potential aging effects.

In its response dated June 21, 2010, the applicant stated that compressed air components downstream of the compressed air system dryers were considered to be in a dry air environment and, therefore, not expected to exhibit aging effects. The staff noted that, as discussed in the references included in GALL Report AMP XI.M24, aging effects such as a loss of material have been a contributor to compressed air system failures. Furthermore, the lack of air quality sampling and performance monitoring as described in GALL Report AMP XI.M24 leaves the quality of the dried air downstream of the system dryers in question. Therefore, by letter dated October 14, 2010, the staff issued RAI 3.3.1.53-2 which requested that the applicant identify an AMP which will properly manage the loss of material due to general, pitting, and crevice corrosion aging effects.

In its response dated November 12, 2010, the applicant stated that the potential for age-related corrosion requiring aging management exists since there is a potential for moisture and/or condensation in compressed air system components downstream of the system dryers. As a result, the applicant amended its LRA in Amendment 13 to include the B.2.21 Compressed Air Monitoring Program, which relies on monitoring and testing of compressed air quality to preclude the incidence of moisture, and preventive maintenance and opportunistic inspections to verify that loss of material is not occurring. In addition, the applicant added many AMR line items to the tables in LRA Section 3.3.2, as descreibed in SER Section 3.3.2.3.1.

The staff finds the applicant's response acceptable because the applicant's amendment includes the B.2.21 Compressed Air Monitoring Program which is consistent with the GALL Report AMP XI.M24, and is capable of managing the loss of material due to general, pitting and crevice corrosion aging effects for compressed air components. The staff's evaluation of the Compressed Air Monitoring Program is documented in SER Section 3.0.3.1.11. The staff's concern described in RAI 3.3.1.53-2 is resolved.

LRA Table 3.3.1, item 3.3.1-57 addresses steel piping and components' external surfaces exposed to air – indoor uncontrolled (external). The GALL Report recommends the use of GALL AMP XI.M36, "External Surfaces Monitoring," to manage loss of material due to general corrosion for this component group. The applicant stated that this line item is not applicable because the compressed air system components having this material, environment, and aging effect were aligned to LRA Table 3.3.1, item 3.3.1-58, which covers management of aging effects for a wide range of steel components in air – indoor uncontrolled (external), air – outdoor (external), and condensation (external) environments using the External Surfaces Monitoring Program. The staff evaluated the applicant's claim and found it acceptable because the proposed line item will effectively manage aging effects for the steel components exposed to an air – indoor uncontrolled (external) environment.

LRA Table 3.3.1, item 3.3.1-59 addresses steel heat exchanger components exposed to air – indoor uncontrolled (external) or air – outdoor (external). The GALL Report recommends the use of GALL AMP XI.M36, "External Surfaces Monitoring," to manage loss of material due to general corrosion for this component group. The applicant stated that this line item is not applicable because its aging effects are managed through two other line items (e.g., items 3.3.1-56 and 3.3.1-58) within the same table. The staff evaluated the applicant's claim and found it acceptable because LRA Table 3.3.1, items 3.3.1-56 and 3.3.1-58 manage aging effects of steel external surfaces through the External Surfaces Monitoring Program for loss of material and wastage and the components in both of the applicant's proposed line items is exposed to the same environments as that described for LRA Table 3.3.1, item 3.3.1-59 (e.g., air – indoor uncontrolled (external) or air – outdoor (external) environments).

LRA Table 3.3.1, item 3.3.1-62 addresses loss of material due to pitting and crevice corrosion in aluminum piping, piping components, and piping elements exposed to raw water in the auxiliary systems. The applicant stated that this line item is not applicable. The staff reviewed LRA Sections 2.3.4 and 3.3 and noted that the LRA has line items for aluminum components exposed to raw water in the station and instrument air systems for which generic note J is cited and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited to manage loss of material. The staff's evaluation of this proposal is documented in SER Section 3.3.2.3.38. The staff reviewed the applicant's FSAR and confirmed that no in-scope aluminum components exposed to raw water are present in the fire protection systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, item 3.3.1-78 addresses loss of material due to pitting and crevice corrosion in stainless steel, nickel-alloy, and copper alloy piping, piping components, and piping elements exposed to raw water for auxiliary systems. The applicant stated that this item is not applicable and to see LRA Table 3.3.1, items 3.3.1-79 through 3.3.1-83. The staff noted that Table 3.3.1, items 3.3.1-79 through 3.3.1-83 cover all of the materials and environment of LRA Table 3.3.1, item 3.3.1-78 except nickel-alloy steel components. The staff reviewed LRA Sections 2.3.4 and 3.3 and did not note any nickel based-alloy piping, piping components, and piping elements exposed to raw water in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, item 3.3.1-87 addresses reduction of neutron-absorbing capacity due to Boraflex degradation in Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water. The applicant stated that this line item is not applicable because it does not use Boraflex spent fuel storage rack neutron-absorbing sheets. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water are present in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3.1, item 3.3.1-95 addresses steel and aluminum piping, piping components, and piping elements externally exposed to controlled indoor air and states that the item is not applicable to CR-3. LRA Table 3.3.1, item 3.3.1-95, correspond to GALL Report Table 3, item 95 which references GALL Report, Table VII.J, items VII.J-1 and VII.J-20 which recommend that there is no aging effect and that no AMP is recommended for this component group exposed to this environment. The staff finds the applicant's determination of not applicable equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.3.1, item 3.3.1-96 addresses steel and stainless steel piping, piping components, and piping elements exposed to concrete and states that the item is not applicable to CR-3. LRA Table 3.3.1, item 3.3.1-96, correspond to GALL Report Table 3, item 96 which references GALL Report, Table VII.J, items VII.J-19 and VII.J-21 which recommend that there is no aging effect and that no AMP is recommended for this component group exposed to this environment. The staff finds the applicant's determination of not applicable equivalent to the GALL Report recommendations and, therefore, acceptable.

By letter dated November 12, 2010, the applicant submitted LRA Amendment No. 13 which revised LRA Table 3.3.1, line item 3.3.1-98, which addresses steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air and states that the item is not applicable to CR-3. LRA Table 3.3.1, item 3.3.1-98, correspond to GALL Report Table 3, item 98 which references GALL Report, Table VII.J, items VII.J-3, VII.J-18, and VII.J-22 which recommends that there is no aging effect, aging mechanism and that no aging management program is recommended for this component group exposed to this environment. The staff finds the applicant's determination of not applicable equivalent aging management to the GALL Report recommendations and, therefore, acceptable.

3.3.2.1.2 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-63 addresses steel fire-rated doors exposed to indoor or outdoor air which are being managed for loss of material due to wear by the Fire Protection and Structures Monitoring programs. The GALL Report recommends the use of GALL AMP XI.M26, "Fire Protection," to ensure that these aging effects are adequately managed. The associated AMR line items cite generic note E, indicating that this aging concern is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited.

GALL AMP XI.M26 recommends using visual inspections to manage loss of material. In its review of components associated with LRA Table 3.3.1, item 3.3.1-63 for which the applicant cited generic note E, the staff noted that the applicant proposed to use the Structures Monitoring Program in addition to the Fire Protection Program and that both programs will perform visual inspections to detect loss of material for the fire-rated doors.

The staff's evaluation of the Fire Protection and Structures Monitoring programs are documented in SER Sections 3.0.3.2.6 and 3.0.3.2.14, respectively. The staff reviewed the LRA and identified that the scope of the Fire Protection Program encompasses aging management of fire protection components, including fire-rated doors. The applicant stated that this program is implemented to manage aging effects of subject components through ongoing plant inspection procedures. The staff noted that one of the enhancements the applicant committed to implement is enhancing the fire doors annual inspection procedure to include criterion for loss of material due to corrosion. The applicant also stated that the Structures Monitoring Program includes periodic inspection and monitoring of the condition of structures and structure component supports. The staff finds the applicant's use of the Fire Protection Program and the Structures Monitoring Program to manage aging of fire-rated doors acceptable because the annual inspection of the fire doors under the Fire Protection Program will detect the potential development and progress of loss of material, while the periodic inspections under the Structures Monitoring Program will supplement the Fire Protection Program to identify potential degradation of structural components (e.g., door frames).

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.3 Cracking and Loss of Material

In LRA Table 3.5.2-1, for AMR items which reference Table 1, items 3.3.1-65, 3.3.1-66, 3.3.1-67, and generic note E, the applicant credited the Fire Protection and ASME Section XI, Subsection IWL programs for managing the aging effect due to cracking and loss of material in the concrete containment dome, wall, basemat, ring girder, and buttresses. However, in Table 3.3.1, items 3.3.1-65, 3.3.1-66, and 3.3.1-67, the GALL Report recommends the Fire Protection and Structures Monitoring programs for cracking and loss of material effect/mechanism in an air-indoor uncontrolled or air-outdoor environment.

The staff has reviewed the AMR results that referenced generic note E, including the discussion provided in Table 3.3.1 for items 3.3.1-65, 3.3.1-66, and 3.3.1-67. The staff determined, for these items, that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report, item II.A.1-7 which recommends the use of GALL AMP XI.S2, "ASME Section XI, Subsection IWL," for managing the aging effect due to cracking and loss of material in the concrete containment dome, wall, basemat, ring girder, and buttresses. A portion of the reactor building containment wall is enclosed by the auxiliary and intermediate buildings and is designed as a fire barrier. The containment wall is 42 inches thick and is lined on the inside with a carbon steel liner plate. The applicant's use of the ASME Section XI, Subsection IWL Program for managing aging mechanisms due to cracking and loss of material will ensure that the containment wall will maintain its fire barrier function.

The staff's review of the applicant's ASME Section XI, Subsection IWL Program is documented in SER Section 3.0.3.1.14. Since the applicant has identified an AMP consistent with the GALL Report recommendations, the staff finds these AMR results acceptable.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.4 Loss of Material Due to Selective Leaching

LRA Table 3.3.1, items 3.3.1-84 and 3.3.1-85 address gray cast iron and copper alloy greater than 15 percent Zn piping, piping components, and piping elements and copper alloy greater than 15 percent Zn heat exchanger components exposed to raw water which are being managed for loss of material due to selective leaching. The LRA credits the Selective Leaching of Materials Program to manage the aging effect, although the applicant cited plant-specific note 305, "Selective leaching is managed by periodic inspections under the Open Cycle Cooling Water System Program in specific applications where operating experience review indicates selective leaching has previously occurred." The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to ensure that these aging effects are adequately managed. The associated AMR line items cite generic note E, indicating that the LRA AMR is consistent with the GALL Report item for material, environment, and aging effect, but a different AMP is credited.

For those line items associated with generic note E, GALL AMP XI.M33 recommends using one-time visual and hardness measurements to determine whether selective leaching has occurred to manage the aging of these line items. In its review of components associated with LRA Table 3.3.1, items 3.3.1-84 and 3.3.1-85 for which the applicant cited generic note E, the staff noted that the Open-Cycle Cooling Water System Program proposes to manage the aging of gray cast iron and copper alloy greater than 15 percent Zn piping, piping components, and piping elements and copper alloy greater than 15 percent Zn heat exchanger components through the use of hardness/scratch testing for selective leaching and visual inspections for discoloration followed by hardness testing, if appropriate, for heat exchanger components.

The staff's evaluation of the applicant's Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.3. In its review of components associated with LRA Table 3.3.1, items 3.3.1-84 and 3.3.1-85, the staff finds the applicant's proposal to manage aging using the Open-Cycle Cooling Water System Program acceptable because the applicant is enhancing its program to include appropriate hardness/scratch tests and visual inspections to detect selective leaching and, as documented in LRA Section B.2.10, the applicant discussed plant-specific operating experience in which multiple instances of selective leaching of components in the nuclear services and decay heat sea water system have been detected and corrected by this program.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.5 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.3.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.3.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the auxiliary systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- reduction of heat transfer due to fouling
- cracking due to SCC
- cracking due to SCC and cyclic loading
- hardening and loss of strength due to elastomer degradation
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling
- loss of material due to pitting and crevice corrosion

- loss of material due to pitting, crevice, and galvanic corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to wear
- loss of material due to cladding breach
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.3.2.2. The staff's review of the applicant's further evaluation follows.

3.3.2.2.1 Cumulative Fatigue Damage

LRA Table 3.3.1, item 3.3.1-02, refers to LRA Section 3.3.2.2.1, which states fatigue is a TLAA as defined in 10 CFR 54.3 and that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The applicant also stated that the evaluations of this TLAA are separately addressed in LRA Section 4.3.

The applicant stated that cumulative fatigue damage for cranes and load handling members subjected to fatigue loading conditions, such as crane runways. are accounted for by design. In addition, crane use is limited and the number of stress cycles experienced is low in terms of fatigue service life when considering the period of extended operation; therefore, no TLAA exists for the fatigue of crane components. The staff noted that the applicant has its Inspection of Overhead Heavy Load and Light Load Handling Systems Program to manage the effects of aging on its cranes. The staff reviewed the Inspection of Overhead Heavy Load and Light Load Handling Systems Program and its evaluation is documented in SER Section 3.0.3.2.5.

LRA Table 3.3.1, item 3.3.1-01, refers to LRA Sections 3.3.2.2.1, which states that the TLAAs on fatigue are addressed separately in LRA Section 4.3. However, it was unclear to the staff whether LRA Section 4.3 has covered the fatigue TLAA for the following components from the applicant's AMR line items: EFP-3 diesel engine exhaust expansion joints and silencers, standpipes, hydrants, and tanks; deaerator, expansion joints, feedwater booster pumps, tanks, feedwater heaters, main feedwater pumps.

By letter dated September 11, 2009, the staff issued RAI 3.3.2.2.1-1 requesting that the applicant identify the subsections of LRA Section 4.3 that discuss these components and discuss the methods used for the TLAA analysis for these components.

In its response dated October 13, 2009, the applicant stated that LRA Section 4.3.2.2, "USAS B31.1.0 Piping - Non-Class 1," evaluated these components. The applicant further stated that non-Class 1 piping components regardless of whether they were aligned to a GALL AMR item are also discussed in LRA Section 4.3.2.2. The applicant clarified that the term "piping components" is consistent with the definition in the GALL Report. The applicant clarified that its TLAA evaluations of the non-Class 1 piping is sorted into two categories: (1) those whose cycles track with plant heatups and cooldowns (such as the main steam and feedwater systems) and (2) those that do not (such as the emergency diesel generator system). The applicant stated that for those systems in which cycles are tracked with plant heatups and cooldowns, a generic evaluation was performed to validate that 7,000 cycles would not be exceeded to demonstrate that the analyses remain valid for the period of extended operation and is presented on LRA pages 4.3-10 and 4.3-11. The staff's review of this TLAA and its evaluation is documented in SER Section 4.3.2.2.2. The applicant also provided the details of its evaluation for those components whose cycles do not track with plant heatups and cooldowns. The applicant discussed the method that was used in order to conclude that these analyses were projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff noted for the components in both categories, the applicant stated that it performed specific evaluations on the components' operating history to validate that 7,000 cycles would not be exceeded to demonstrate that the analyses remain valid or have been projected for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii), respectively. The staff's review of this TLAA and the applicant's disposition, in accordance with 10 CFR 54.21(c)(1)(i) or 10 CFR 54.21(c)(1)(ii), is documented in SER Section 4.3.2.2.2.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.2.1-1 acceptable because the applicant confirmed that its analyses in LRA Section 4.3.2.2 includes USAS B31.1.0 Piping - Non-Class 1 components, including those components described in RAI 3.3.2.2.1-1 and the applicant has performed its evaluations to disposition its TLAAs for these components in accordance with 10 CFR 54.21(c)(1)(i) or 10 CFR 54.21(c)(1)(ii). The staff's concern described in RAI 3.3.2.2.1-1 is resolved.

The staff verified that in LRA Sections 4.3.2.2, the applicant provided its fatigue TLAA evaluation for components included in this section. The staff's evaluation of this TLAA, USAS B31.1.0 Piping - Non-Class 1 components, is documented in SER Section 4.3.2.2.2.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3.1, item 3.3.1-03, refers to LRA Section 3.3.2.2.2 and addresses stainless steel heat exchanger tubes exposed to treated water which are being managed for reduction of heat transfer due to fouling. The applicant stated that the further evaluation criteria do not apply because SRP-LR Table 3.3-1, item 3 references GALL Report related item AP-62 which only applies to BWR plants.

The staff reviewed SRP-LR Table 3.3-1, item 3.3.1-03 and noted that it references GALL Report item AP-62, which only applies to BWR plants. The staff finds that SRP-LR Section 3.3.2.2.2 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

3.3.2.2.3 Cracking Due to Stress-Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.3 against the criteria in SRP-LR Section 3.3.2.2.3.

(1) LRA Section 3.3.2.2.3.1 addresses cracking due to SCC in the stainless steel components of a BWR standby liquid control system, stating that this aging effect is applicable to BWRs only. SRP-LR Section 3.3.2.2.3, item 1 states that stainless steel components in the BWR standby liquid control system can experience cracking due to SCC. The staff finds that SRP-LR Section 3.3.2.2.3, item 1 is not applicable to CR-3

because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(2) LRA Table 3.3.1, item 3.3.1-05, refers to LRA Section 3.3.2.2.3.2 and addresses stainless steel and stainless steel clad steel heat exchanger components exposed to treated water greater than 60 °C (140 °F) which are being managed for cracking due to SCC. The applicant stated that this further evaluation section applies to GALL Report related items A-71 and A-85 which are only associated with BWR reactor water cleanup systems and are not applicable to PWRs. The staff noted that SRP-LR Table 3.3-1, item 3.3.1-05 does reference GALL Report related items A-71 and A-85 which only apply to BWR reactor water cleanup systems. The staff finds that SRP-LR Section 3.3.2.3 item 2 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(3) LRA Table 3.3.1, item 3.3.1-06, refers to LRA Section 3.3.2.2.3.3 and addresses stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust which are being managed for cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant addressed the further evaluation criteria by stating that this program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

The staff reviewed LRA Section 3.3.2.2.3.3 against the criteria in SRP-LR Section 3.3.2.2.3, item 3, which states that cracking due to SCC could occur for stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. In its review of components associated with LRA Table 3.3.1, item 3.3.1-6, the staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because the program uses visual inspection techniques to detect discontinuities and imperfections on the surface of the component.

The staff determines that LRA Section 3.3.2.2.3 is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking Due to Stress-Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4.

(1) LRA Table 3.3.1, item 3.3.1-07, refers to LRA Section 3.3.2.2.4.1 and addresses stainless steel components in the non-regenerative heat exchanger exposed to treated water greater than 60 °C (140 °F) in the makeup and purification system which are being managed for cracking due to SCC and cyclic loading by the Water Chemistry and the One-Time Inspection programs. The applicant addressed the further evaluation criteria

of the SRP-LR by stating that the Water Chemistry Program controls water chemistry for prevention or mitigation of cracking and the One-Time Inspection Program verifies that unacceptable degradation of the applicable components is not occurring. In addition, the applicant stated that its basis for using the One-Time Inspection Program in lieu of monitoring the shell side water for radioactivity and eddy current testing of tubes is the NRC staff's position documented in Section 3.3.2.2.8 of NUREG-1785, "Safety Evaluation Report Related to the License Renewal of H.B. Robinson Steam Electric Plant, Unit 2."

The staff reviewed LRA Section 3.3.2.2.4.1 against the criteria in SRP-LR Section 3.3.2.2.4, item 1, which states that cracking due to SCC and cyclic loading could occur for stainless steel components in the non-regenerative heat exchanger exposed to treated water greater than 60 °C (140 °F) in the makeup and purification system. The SRP-LR also states although the existing AMP relies on monitoring and control of primary water chemistry to manage cracking due to SCC, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. It further states that an acceptable verification program includes monitoring of the shell side water temperature and radioactivity and eddy current testing of heat exchanger tubes.

The staff's evaluation of the applicant's Water Chemistry Program and One-Time Inspection programs is documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff reviewed the cited section of NUREG-1785 and also noted a comparable position in NUREG-1929, "Safety Evaluation Report Related to the License Renewal of Beaver Valley Power Station." The staff noted that the Water Chemistry Program controls impurities known to accelerate corrosion and cracking, and the effectiveness of the Water Chemistry Program is verified with the One-Time Inspection Program through inspections using NDE techniques that have been determined to be effective for the identification of cracking. However, the applicant did not specify the nondestructive testing methodology that would be used as an alternative to eddy current testing of the heat exchanger tubes. In order to clarify this aspect, in a letter dated November 16, 2010, the staff issued RAI 3.3.2.2.4-1 requesting that the applicant specifically state the NDE method that will be used during the one-time inspection, in lieu of eddy current testing, and to justify the effectiveness of the proposed methodology based on plant-specific or industry operating experience. Pending the staff's review of the applicant's response to the RAI, this issue is considered to be an Open Item which will be tracked as **OI-3.3.2.2.4.1-1**.

(2) LRA Table 3.3.1, item 3.3.1-08, referes to LRA Section 3.3.2.2.4.2 and addresses stainless steel components of the regenerative heat exchanger that are exposed to treated borated water greater than 60 °C (140 °F) affected by cracking due to SCC. The applicant stated that this line item is not applicable because it does not have regenerative heat exchangers in the makeup and purification system. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have regenerative heat exchangers in the makeup and purification system. The staff reviewed the applicant's FSAR and confirmed that there are no regenerative heat exchangers in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

(3) LRA Table 3.3.1, item 3.3.1-09, refers to LRA Section 3.3.2.2.4.3 and addresses stainless steel high-pressure pump casings exposed to the PWR chemical and volume control system which are being managed for cracking due to SCC and cyclic loading by

the Water Chemistry Program and the One-Time Inspection Program. The applicant addressed the further evaluation requirements by stating that cracking of the high-pressure pumps in the makeup and purification system is managed by the Water Chemistry Program, which provides for monitoring and control of water chemistry using site procedures and processes for the prevention or mitigation of the cracking aging effect. The applicant stated the One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.4.3 against the criteria described in SRP-LR Section 3.3.2.2.4, item 3, which states that SCC and cyclic loading could occur for stainless steel pump casings for the PWR high-pressure pumps in the chemical and volume control system. The SRP-LR also states that the existing Water Chemistry Program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific AMP be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are adequately managed.

The staff reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, item 3.3.1-9, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and the One-Time Inspection Program acceptable because the applicant is managing these components consistent with the recommendations in GALL Report AMR item VII.E1-7, the applicant's Water Chemistry Program controls peak levels of various contaminants (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) below the system-specific limits that can accelerate corrosion and cracking, and the applicant's One-Time Inspection Program performs appropriate NDE capable of detecting cracking due to SCC and cyclic loading to either verify that unacceptable degradation is not occurring or prompts actions that assure the intended function of the components will be maintained.

(4) LRA Table 3.3.1, item 3.3.1-10 refers to LRA Section 3.3.2.2.4.4 and addresses high-strength steel closure bolting exposed to air with steam or water leakage which are being managed for cracking due to SCC and cyclic loading by the Bolting Integrity Program. The GALL Report recommends the use of GALL AMP XI.M18, "Bolting Integrity," to manage cracking due to SCC and cyclic loading for this component group. The applicant stated there have been industry instances of cracking of carbon steel and low alloy steel bolting due to SCC and these failures have been attributed to high yield strength materials (greater than 150 ksi), leaking gaskets, and exposure to contaminants such as lubricants containing molybdenum disulfide. The applicant stated that it selects proper bolting material, in conjunction with the proper selection of lubricants, and controls application of bolt torque. The applicant further stated that these measures have been effective in eliminating SCC of bolting and industry data and plant-specific operating experience supports this conclusion; therefore, LRA Table 3.3.1, item 3.3.1-10, states that this item is not applicable.

The staff finds the applicant's determination acceptable because the proper selection of bolting materials ensures that the bolting materials are resistant to cracking due to SCC and cyclic loading and the proper control of preload ensures uniform compression and adequate tightness of gaskets preventing steam or water leakage. Also, the proper selection of lubricants ensures that the bolting is not exposed to elements causing SCC such as sulfur.

Based on the programs identified above, pending resolution of OI-3.3.2.2.4.1-1, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.4 criteria. For those line items that apply to LRA Section 3.3.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5.

(1) LRA Table 3.3.1, item 3.3.1-11 refers to LRA Section 3.3.2.2.5.1 and addresses elastomers in control room ventilation systems exposed to indoor uncontrolled air on internal or external surfaces which are being managed for hardening and loss of strength due to elastomer degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs. The applicant addressed the further evaluation criteria by stating that the AMPs will perform visual inspections of the internal and external surfaces of the elastomers during maintenance activities for internal inspections and system inspections and walkdowns for external inspections.

The staff reviewed LRA Section 3.3.2.2.5.1 against the criteria in SRP-LR Section 3.3.2.2.5, item 1, which states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components of heating and ventilation systems exposed to air – indoor uncontrolled (internal/external). The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed and the acceptance criteria is described in BTP RLSB-1 (Appendix A.1 of the SRP-LR).

In its review, the staff noted that the applicant has committed to enhancing its External Surfaces Monitoring Program to include elastomeric materials and to enhance program procedures to detect hardening and loss of strength of elastomers. The staff also noted that no procedures for the detection of hardening and loss of strength of elastomers were proposed. Given that the detection of hardening and loss of strength of elastomers generally requires some form of mechanical or manual interaction with the elastomer and the External Surfaces Monitoring Program is generally a visual inspection program, it is not clear to the staff that the unstated procedural enhancements proposed by the applicant will be sufficient to adequately detect the aging effect under consideration. However, the staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program has been expanded from the corresponding GALL Report AMP to specifically include physical manipulation and other investigative methods designed specifically to detect hardening and loss of strength in elastomers. By letter dated December 1, 2009, the staff issued RAI B.2.23-1 requesting that the applicant confirm that the enhancements proposed for the External Surfaces Monitoring

Program will specifically include physical manipulation and other investigative methods designed specifically to detect hardening and loss of strength in elastomers.

In its response dated December 30, 2009, the applicant stated that its External Surfaces Monitoring Program is credited for detecting aging effects that are evident by visual observation such as cracking, discoloration, fretting, and delamination. The applicant also stated that the External Surfaces Monitoring Program is complemented in each instance by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program which uses visual as well as physical manipulation and/or testing to verify hardness and loss of strength of the elastomeric material.

The staff finds the applicant's response acceptable because, based on a review of the LRA auxiliary system tables related to heating and ventilation where elastomeric materials are listed, both programs are always credited. Between the two programs, appropriate visual/physical manipulation or testing methods will be used to detect aging effects. The staff's concern described in RAI B.2.23-1 is resolved.

The staff's evaluations of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs are documented in SER Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. The staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs acceptable because appropriate visual/physical manipulation or testing methods will be used to detect aging effects and the programs have controls to ensure that the inspections will occur at appropriate intervals.

(2) LRA Section 3.3.2.2.5, associated with LRA Table 3.3.1, item 3.3.1-12, addresses hardening and loss of strength due to elastomer degradation in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or treated borated water. The applicant stated that this item is not applicable because the spent fuel pool cooling and cleanup systems do not have elastomeric linings. The staff reviewed LRA Section 2.3.3, LRA Section 3.3, and the FSAR and confirmed that there are no in-scope elastomer lined filters, valves, and ion exchangers exposed to treated water or treated borated water present in the spent fuel cooling and cleanup systems and, therefore, finds the applicant's determination acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5 criteria. For those line items that apply to LRA Section 3.3.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

LRA Table 3.3.1, item 3.3.1-13 refers to LRA Section 3.3.2.2.6 and addresses reduction of neutron-absorbing capacity and loss of material due to general corrosion in Boral spent fuel storage racks exposed to a treated borated water environment. The LRA states that the AMR determined that there has been no adverse operating experience at CR-3 with regard to reduction of neutron-absorbing capacity and loss of material due to general corrosion for Boral used in the spent fuel storage racks exposed to treated water or treated borated water.

SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion may occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed. By letter dated September 2, 2009, the staff issued RAI 3.3.2.2.6-1 requesting that the applicant describe how the aging effects addressed in the SRP-LR are being managed at CR-3. By letter dated October 2, 2009, the applicant responded by stating that the aging effects for Boral are insignificant and do not require aging management and reference the staff evaluations for the V.C. Summer Nuclear Station and the Brunswick Steam Electric Plant where it was determined that the aging effects are insignificant. On October 28, 2009, the staff held a teleconference with the applicant (documented in a teleconference summary dated December 3, 2009) to get clarification on the applicant's proposed aging management of Boral in the spent fuel pool. Subsequently, by letter dated November 30, 2009, the staff issued RAI 3.3.2.2.6-2 requesting that the applicant provide details on the planned aging management for Boral used in the spent fuel storage racks.

In May 2010, the NRC issued ISG LR-ISG-2009-01, "Aging Management of Spent Fuel Pool Neutron-Absorbing Materials other than Boraflex." LR-ISG-2009-01 puts forth guidance for aging management of spent fuel pool materials other than Boraflex, including Boral. LR-ISG-2009-01 states that "due to the staff's determination that the new generic AMP is adequate for managing the aging effects with no further plant-specific evaluation recommended, the acceptance criteria and review procedures in SRP-LR Sections 3.3.2.2.6 and 3.3.3.2.6, respectively are no longer necessary."

By letter dated January 27, 2010, the applicant provided its response to RAI 3.3.2.2.6-2 revising LRA Table 3.3.1, item 3.3.1-13 to state that:

> CR-3 has identified reduction of neutron absorbing capacity, change in dimensions, and loss of material as applicable aging effects consistent with the recommendations of LR-ISG-2009-01. These aging effects are managed by the Fuel Pool Rack Neutron Absorber Monitoring Program, which is a plant specific program. The Fuel Pool Rack Neutron Absorber Monitoring Program has been compared to the aging management program recommendations of LR-ISG-2009-01, and determined to be consistent with the ISG.

The staff's evaluation of the Fuel Pool Rack Neutron Absorber Monitoring Program is documented in SER Section 3.0.3.3.1. The applicant's response to RAI 3.3.2.2.6-2 also stated that LRA Section 3.3.3.2.6 should be replaced with the statement "deleted consistent with the recommendations of LR-ISG-2009-01."

Based on its review, the staff finds the applicant's responses to RAI 3.3.2.2.6-1 and RAI 3.3.2.2.6-2 acceptable because the applicant has included Boral in an AMP consistent with the guidance given in LR-ISG-2009-01.

Based on the programs identified above, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.6 criteria. For those line items that apply to LRA Section 3.3.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the following criteria in SRP-LR Section 3.3.2.2.7:

(1) LRA Table 3.3.1, items 3.3.1-14, 3.3.1-15, and 3.3.1-16 refer to LRA Section 3.3.2.2.7.1 and address steel piping, piping components, piping elements, tubing, and valve bodies in the reactor coolant pump lube oil leakage collection system exposed to lubricating oil which are being managed for loss of material due to general, pitting, and crevice corrosion by the Lubricating Oil Analysis and the One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program augmented by the One-Time Inspection Program to verify program effectiveness. The applicant also stated that the Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it does, additional actions are triggered to assure that the intended function of affected components will be maintained during the period of extended operation. The applicant also stated that a one-time inspection of the lower portion of the reactor coolant pump oil collection tanks will be performed to ensure that corrosion is not occurring.

    The staff reviewed LRA Section 3.3.2.2.7.1 against the criteria in SRP-LR Section 3.3.2.2.7, item 1, which states that loss of material due to general, pitting, and crevice corrosion could occur in steel piping, tubing, valves, and tanks in the reactor coolant pump lube oil leakage collection system exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of the lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occuring and that the component's intended function will be maintained during the period of extended operation. The SRP-LR also states that corrosion may occur at locations in the reactor coolant pump oil collection tank and that the effectiveness of the program should be verified by a one-time inspection to ensure that corrosion is not occurring.

    The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, items 3.3.1-14, 3.3.1-15, and 3.3.1-16, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general, pitting, and crevice corrosion by periodic sampling of lubricating oil to maintain contaminants at acceptable limits and through a one-time inspection of steel piping, piping components, piping elements, and the reactor coolant pump oil collection tanks exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

(2) LRA Table 3.3.1, itemb 3.3.1-17, refers to LRA Section 3.3.2.2.7.2 and addresses loss of material due to general, pitting, and crevice corrosion in steel components in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water, stating that this aging effect is applicable to BWRs only. The staff finds that SRP-LR Section 3.3.2.2.7, item 2 is not applicable to CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

(3) LRA Table 3.3.1, item 3.3.1-18, refers to LRA Section 3.3.2.2.7.3 and addresses stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust which are being managed for loss of material due to general (steel only), pitting, and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant addressed the further evaluation criteria by stating that this program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

The staff reviewed LRA Section 3.3.2.2.7.3 against the criteria in SRP-LR Section 3.3.2.2.7, item 3, which states that loss of material due to general (steel only), pitting, and crevice corrosion could occur for steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.2.12. In its review of components associated with LRA Table 3.3.1, item 3.3.1-18, the staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because the program uses visual inspection techniques to detect discontinuities, imperfections, loss of material, and evidence of corrosion mechanisms, such as rust, oxidation, and discoloration.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7 criteria. For those line items that apply to LRA Section 3.3.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-19, refers to LRA Section 3.3.2.2.8 and addresses steel piping, piping components, and piping elements buried in soil, regardless of the presence of pipe coatings or wrappings, which are being managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion by the Buried Piping and Tanks Inspection Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the program includes preventive measures to mitigate degradation (e.g., coatings and wrappings required by design) and visual inspections of external surfaces of buried piping components, when excavated, for evidence of coating damage and degradation. The applicant also stated in LRA Section B.2.20 that plant-specific operating experience reviews demonstrated that no leaks had occurred in buried piping due to external corrosion. The applicant further stated that industry operating experience was reviewed through 2005 and will continue to be reviewed through the period of extended operation to determine if changes to the program will be required.

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The SRP-LR also states that the GALL Report AMP relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion. The GALL Report also states that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The staff's evaluation of the applicant's Buried Piping and Tanks Inspection Program is documented in SER Section 3.0.3.1.10. In its review of components associated with LRA Table 3.3.1, item 3.3.1-19, the staff finds the applicant's proposal to manage aging using the Buried Piping and Tanks Inspection Program acceptable because the program is consistent with the GALL Report recommendations in that it implements preventive measures and inspections of coatings, inspections may result in changes to the program, and the program is evaluated against industry and plant operating experience.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.8 criteria. For those line items that apply to LRA Section 3.3.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9.

(1) LRA Table 3.3.1, item 3.3.1-20, refers to LRA Section 3.3.2.2.9.1 and addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion for carbon steel piping and components exposed to fuel oil, stating that fuel oil quality is maintained by the Fuel Oil Chemistry Program through monitoring and controlling fuel oil contamination in accordance with the plant's TSs and the guidelines of the ASTM. The applicant also stated that exposure to fuel oil contaminants is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks. The One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it does, it triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.9.1 against the criteria in SRP-LR Section 3.3.2.2.9, item 2, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. The SRP-LR also states that the existing program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. The SRP-LR further states that the effectiveness of the program to manage corrosion and fouling should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Fuel Oil Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, item 3.3.1-19, the staff finds the applicant's proposal to manage aging effects using the Fuel Oil Chemistry and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling by maintaining contaminants at acceptable limits and through a one-time inspection of steel piping, piping components, and piping elements exposed to fuel oil to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems.

(2) LRA Table 3.3.1, item 3.3.1-21 refers to LRA Section 3.3.2.2.9.2 and addresses steel heat exchanger components exposed to lubricating oil which are being managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling by the Lubricating Oil Analysis and the One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program as augmented by the One-Time Inspection Program to verify program effectiveness. The applicant also stated that the Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it does, it triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.9.2 against the criteria in SRP-LR Section 3.3.2.2.9, item 2, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling could occur for steel heat exchanger components exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, item 3.3.1-21, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling by periodic sampling of lubricating oil to maintain contaminants at acceptable limits and through a one-time inspection of steel piping, piping components, and piping elements exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program in applicable auxiliary systems.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10.

(1) LRA Table 3.3.1, item 3.3.1-22 references LRA Section 3.3.2.2.10.1 and addresses spent fuel pool cooling and cleanup steel components with elastomer lining exposed to treated water and treated borated water. The applicant stated that this line item is not applicable because its spent fuel pool cooling and cleanup components do not have elastomer linings. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the spent fuel pool cooling and cleanup system that include steel components with elastomer lining exposed to treated water and treated borated water. The staff reviewed the applicant's FSAR and confirmed that no in-scope steel components with elastomer lining exposed to treated water and treated borated water are present in the spent fuel pool cooling and cleanup system and, therefore, finds the applicant's determination acceptable.

(2) LRA Table 3.3.1, items 3.3.1-23 and 3.3.1-24 reference LRA Section 3.3.2.2.10.2 and address stainless steel heat exchangers and aluminum and steel with stainless steel clad piping, piping components, and piping elements exposed to treated water. The GALL Report recommends the Water Chemistry Program augmented by the One-Time Inspection Program to manage loss of material for this component group. The applicant stated that this line item is not applicable because the items are only applicable to BWR plants and that the SRP-LR incorrectly identifies this item as applicable to both BWR and PWR plants.

The staff noted that the SRP-LR, the GALL Report, and items 3.3.1-23 and 3.3.1-24 are only mentioned in the spent fuel pool cooling and cleanup, reactor water cleanup, and shutdown cooling systems which are all related to BWR plants. The staff also noted that these line items are only applicable to BWR systems based on the lower oxygen and residual boron concentrations existing in similar PWR systems. The staff finds the applicant's determination that these items are not applicable acceptable because the GALL Report only references BWR systems for LRA Table 3.3.1, items 3.3.1-23 and 3.3.1-24.

(3) LRA Table 3.3.1, item 3.3.1-25 refers to LRA Section 3.3.2.2.10.3 and addresses copper alloy HVAC piping and components exposed to condensation (external). The GALL Report recommends the use of a plant-specific AMP to be evaluated to manage loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the component, material,

environment, and aging effect/mechanism does not apply to the ventilation system piping, piping components, and piping elements.

The staff reviewed the applicant's FSAR Sections 5.5 and 9.7.2 and confirmed that no in-scope copper alloy HVAC ducting and components exposed to condensation (external) are present in the systems and, therefore, finds the applicant's determination acceptable.

(4) LRA Table 3.3.1, item 3.3.1-26 refers to LRA Section 3.3.2.2.10.4 and addresses copper alloy piping, piping components, and piping elements exposed to lubricating oil which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program as augmented by the One-Time Inspection Program to verify program effectiveness. The applicant also stated that the Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it does, it triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.10.4 against the criteria in SRP-LR Section 3.3.2.2.10, item 4, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, item 3.3.1-26, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control loss of material due to pitting and crevice corrosion by periodic sampling of lubricating oil to maintain contaminants at acceptable limits and through one-time inspections of copper alloy piping, piping components, and piping elements exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

(5) LRA Table 3.3.1, item 3.3.1-27 refers to LRA Section 3.3.2.2.10.5 and addresses stainless steel HVAC ducting and components exposed to condensation which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material due to pitting and crevice corrosion could occur for stainless steel HVAC ducting and components exposed to condensation and that the Inspection of Internal

Surfaces in Miscellaneous Piping and Ducting Components Program will be used to manage loss of material due to pitting and crevice corrosion of internal surfaces of stainless steel HVAC housings exposed to condensation.

The staff noted that the applicant did not address aluminum piping, piping components, and piping elements in its evaluation in LRA Section 3.3.2.2.10.5. The staff reviewed the AMR systems tables and determined that the applicant does have aluminum piping in its HVAC systems but none of the AMR line items for aluminum piping in HVAC systems list an environment of condensation.

The staff reviewed LRA Section 3.3.2.2.10.5 against the criteria in SRP-LR Section 3.3.2.2.10, item 5, which states that loss of material due to pitting and crevice corrosion could occur for stainless steel HVAC ducting and components exposed to condensation. The SRP-LR also states that loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. The staff noted that this program consists of existing preventive maintenance, surveillance testing, and periodic testing work order tasks that will provide the opportunity for the visual inspections of internal surfaces of piping and ducting components. The staff also noted that these periodic visual inspections are capable of detecting discontinuities and imperfections on the surface of the component that are indicative of loss of material due to pitting and crevice corrosion. In its review of components associated with LRA Table 3.3.1, item 3.3.1-27, the staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because this program will perform periodic visual inspections of stainless steel HVAC ducting and components that will be capable of detecting surface discontinuities and imperfections that are signs of loss of material.

(6) LRA Table 3.3.1, item 3.3.1-28 refers to LRA Section 3.3.2.2.10.6 and addresses loss of material due to pitting and crevice corrosion which could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to condensation. LRA Section 3.3.2.2.10.6 references item 3.3.1-70 which is for exposure to a raw water environment, whereas the SRP-LR references item 3.3.1-28 which is for exposure to condensation. The applicant stated that it assumed a raw water environment for these components in place of a condensing environment because of the ability of condensation to concentrate contaminants. The applicant also stated that it plans to use the Fire Water System Program to manage the loss of material due to pitting and crevice corrosion of its Fire Protection System copper alloy piping. The applicant further stated that its Fire Water System Program includes system pressure monitoring, wall thickness evaluations, periodic flow and pressure testing in accordance with NFPA commitments, and periodic visual inspection of overall system condition.

The staff reviewed LRA Section 3.3.2.2.10.6 against the criteria in SRP-LR Section 3.3.2.2.10, item 6, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effects are adequately managed. Acceptance criteria are described in SRP-LR Appendix A.1, BTP RLSB-1.

The staff reviewed AMR items associated with LRA Table 3.3.1, item 3.3.1-70 for copper alloy piping, piping components, and piping elements exposed to raw water. The staff finds the applicant's approach of assuming a raw water environment in place of a condensing environment acceptable because a condensing environment tends to concentrate impurities, thereby making it more like a raw water environment and managing aging due to exposure to a raw water environment is equally effective as a condensing environment for these components.

The staff reviewed the applicant's Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.7. The staff notes that the Fire Water System Program credits periodic flow testing, pressure testing, thickness evaluations, and visual inspections of the fire water piping system to monitor the overall condition of the fire water piping system. The staff also notes that loss of material due to pitting or crevice corrosion is detectable by periodic flow testing, pressure testing, visual inspections, and piping thickness evaluations. The staff finds the applicant's proposal to manage aging using the Fire Water System Program acceptable because the program includes inspection and testing methods which can detect loss of material.

(7) LRA Table 3.3.1, item 3.3.1-29 refers to LRA Section 3.3.2.2.10.7 and addresses stainless steel piping, piping components, and piping elements exposed to soil affected by loss of material due to pitting and crevice corrosion. The applicant stated that this line item is not applicable because the systems containing service water and the fire protection, diesel fuel oil, and emergency diesel generator systems do not contain stainless steel components exposed to soil.

The staff reviewed the applicant's FSAR and conducted staff inquiries during the AMP audit which indicated that beyond the potential use of stainless steel bolting mentioned above, no buried stainless steel piping was present and confirmed that no in-scope stainless steel piping, piping components, and piping elements exposed to soil are present in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

(8) LRA Table 3.3.1, item 3.3.1-30 refers to LRA Section 3.3.2.2.10.8 and addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements of the BWR standby liquid control system that are exposed to sodium pentaborate solution, stating that this aging effect is not applicable to CR-3 because it is only applicable to BWRs.

SRP-LR Section 3.3.2.2.10, item 8 states that loss of material due to pitting and crevice corrosion may occur in stainless steel piping, piping components, and piping elements of the BWR standby liquid control system exposed to sodium pentaborate solution. The staff finds that SRP-LR Section 3.3.2.2.10, item 8 is not applicable to CR-3 because CR-3 is a PWR and the staff guidance in this SRP-LR section is only applicable to BWRs.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.3.1, item 3.3.1-31 refers to LRA Section 3.3.2.2.11 which states that the aging effect is not applicable to CR-3 and that it is applicable to BWRs only.

SRP-LR Section 3.3.2.2.11 addresses loss of material in copper alloy auxiliary system components exposed to a treated water environment. SRP-LR Table 3.3-1, item 31 refers to SRP-LR Section 3.3.2.2.11 and states that this item is applicable only to BWRs. The staff finds that SRP-LR Section 3.3.2.2.11 is not applicable to CR-3 because CR-3 is a PWR and the staff guidance in this SRP-LR section is only applicable to BWRs.

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.12 against the criteria in SRP-LR Section 3.3.2.2.12.

(1) LRA Table 3.3.1, item 3.3.1-32 refers to LRA Section 3.3.2.2.12.1 and addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion for stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil, stating that fuel oil quality is maintained by the Fuel Oil Chemistry Program through monitoring and controlling fuel oil contamination in accordance with the plant's TSs and the guidelines of the ASTM. The applicant also stated that exposure to fuel oil contaminants is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks. The One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it does, it triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.12.1 against the criteria in SRP-LR Section 3.3.2.2.12, item 1, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The SRP-LR also states that the existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion and fouling should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Fuel Oil Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.3.1, item 3.3.1-32, the staff finds the applicant's proposal to manage aging effects using the Fuel Oil Chemistry and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling by maintaining contaminants at acceptable limits and through a one-time inspection of steel piping, piping components, and piping elements exposed to fuel oil to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems.

(2) LRA Table 3.3.1, item 3.3.1-33 refers to LRA Section 3.3.2.2.12.2 and addresses stainless steel piping, piping components, and piping elements exposed to lubricating oil which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Lubricating Oil Analysis and the One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program as augmented by the One-Time Inspection Program to verify program effectiveness. The applicant also stated that the Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it is, it triggers additional actions are triggered to assure that the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.12.2 against the criteria in SRP-LR Section 3.3.2.2.12, item 2, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur for stainless steel piping, piping components, and elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occuring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA item 3.3.1-33, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by periodic sampling of lubricating oil to maintain contaminants at acceptable limits and through one-time inspections of stainless steel piping, piping components, and piping elements exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12 criteria. For those line items that apply to LRA Section 3.3.2.2.12, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-34 refers to LRA Section 3.3.2.2.13 and addresses internal and external surfaces of elastomers exposed to indoor uncontrolled air which are being managed for loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs. The applicant addressed the further evaluation criteria by stating that the AMPs will perform visual inspections of the internal and external surfaces of the elastomers during maintenance activities for internal inspections and system inspections and walkdowns for external inspections.

The staff reviewed LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.3.2.2.13, which states that loss of material due to wear could occur in the elastomer seals and components exposed to air – indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs is documented in SER Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. In its review, the staff noted that wear of elastomers can generally be detected by visual observation such that an AMP which is based on visual inspection could be expected to adequately detect this aging mechanism. The staff also noted that the applicant has expanded both of the LRA AMPs beyond their GALL Report recommendations to include elastomers and to detect aging effects, such as wear, associated with elastomers. In its review of components associated with item 3.3.1-34, the staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs acceptable because these programs will be capable of detecting the aging effect under consideration because appropriate inspection techniques are included in the program.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.13 criteria. For those line items that apply to LRA Section 3.3.2.2.13, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.14 Loss of Material Due to Cladding Breach

LRA Table 3.3.1, item 3.3.1-35 references LRA Section 3.3.2.2.14 and addresses steel with stainless steel cladding pump casings exposed to treated borated water which are being managed for loss of material due to cladding breach. The applicant stated that this line item is not applicable because its charging pumps are fabricated from stainless steel and not from carbon steel with stainless steel cladding. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results in the auxiliary systems that include steel charging pump casings with stainless steel cladding exposed to treated water. The staff reviewed the applicant's FSAR and confirmed that there are no in-scope steel charging pump casings with stainless steel cladding exposed to treated water and, therefore, finds the applicant's determination acceptable.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-61, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-61, via notes F through J, the applicant indicated which combinations of component type, material, environment, and AERM do not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.3.2.3.1 Air Handling Ventilation and Cooling System - Summary of Aging Management Review – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the air handling ventilation and cooling system component groups.

In LRA Table 3.3.2-1, the applicant stated that for carbon or low alloy steel EFP-3 diesel engine exhaust expansion joints and silencers and stainless steel EFP-3 diesel engine exhaust expansion joints and silencers exposed to diesel exhaust internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3. In LRA Table 3.3.2-18, the applicant stated that for carbon or low alloy steel EFP-3 diesel engine exhaust piping, piping components, and piping elements and carbon or low alloy steel and stainless steel expansion joints exposed to diesel exhaust internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3. In LRA Table 3.3.2-21, the applicant stated that for nickel-based post-accident sampling system sample cooler components exposed to treated water internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3. In LRA Table 3.3.2-33, the applicant stated that for carbon or low alloy steel and stainless steel diesel exhaust silencers and stainless steel expansion joints exposed to diesel exhaust internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3. In LRA Table 3.3.2-36, the applicant stated that for carbon or low alloy steel piping, piping components, standpipes, hydrants, and tanks exposed to diesel exhaust internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3.

The staff noted that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff further noted that the evaluations of these TLAAs are separately addressed in LRA Section 4.3. The AMR line items cite generic note J.

The staff noted that it was unclear whether LRA Section 4.3 has covered fatigue TLAA for the following components from the applicant's AMR line items: EFP-3 diesel engine exhaust expansion joints and silencers, standpipes, hydrants, and tanks; deaerator; expansion joints; feedwater booster pumps and tanks; feedwater heaters; and main feedwater pumps.

The staff reviewed LRA Section 4.3 but was not able to locate the discussion for these AMR line items. By letter dated September 11, 2009, the staff issued RAI 3.3.2.2.1-1 requesting that the applicant identify the subsections of LRA Section 4.3 that discuss these components and provide the methods used for the TLAA analysis for these components.

The staff's review of RAI 3.3.2.2.1-1 and its evaluation and acceptance of the applicant's response are documented in SER Section 3.3.2.2.1.

The staff verified that in LRA Section 4.3.2.2, the applicant provided its fatigue TLAA evaluation for components included in this section. The staff's evaluation of this TLAA, USAS B31.1.0 Piping - Non-Class 1 components, is documented in SER Section 4.3.2.2.2.

In LRA Tables 3.3.2-1, 3.3.2-18, and 3.3.2-36, the applicant stated that carbon or low alloy steel emergency feedwater pump diesel engine exhaust, piping, piping components, piping elements, standpipes, hydrants, tanks, and expansion joints exposed to diesel exhaust are being managed for loss of material due to general, crevice, and pitting corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the proposed AMP acceptable to manage aging for these components because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic inspections of the component internal surfaces which can detect loss of material due to various corrosion mechanisms.

In LRA Tables 3.3.2-1 and 3.3.2-18, the applicant stated that stainless steel expansion joints and diesel engine exhaust expansion joints and silencers exposed to diesel exhaust are being managed for loss of material due to pitting and crevice corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J. The staff reviewed AMR line items in the GALL Report where the component and material is stainless steel expansion joints and silencers exposed to diesel exhaust and noted that GALL Report items VII.H2-1 and VII.H2.1, for stainless steel piping exposed to diesel exhaust, recommend further evaluation of a plant-specific AMP to manage the effects of loss of material due to pitting and crevice corrosion and cracking due to SCC.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of loss of material due to pitting and crevice corrosion and cracking due to SCC because it performs periodic visual inspections of the internal surfaces of stainless steel expansion joints and silencers that are capable of detecting loss of material and cracking.

In LRA Tables 3.3.2-1, 3.3.2-4, 3.3.2-5, 3.3.2-6, 3.3.2-7, 3.3.2-8, 3.3.2-9, 3.3.2-10, 3.3.2-11, 3.3.2-12, 3.3.2-13, 3.3.2-15, 3.3.2-19, 3.3.2-21, 3.3.2-22, 3.3.2-27, 3.3.2-32, 3.3.2-38, 3.3.2-42, 3.3.2-44, 3.3.2-49, 3.3.2-50, 3.3.2-51, 3.3.2-52, 3.3.2-54, 3.3.2-55, 3.3.2-56, 3.3.2-57, 3.3.2-60, and 3.3.2-61, the applicant stated that for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment there is no aging effect and no AMP is proposed. The AMR line items cite generic note J.

The staff finds the applicant's proposal acceptable because GALL Report item VII.J-1, which is similar, recommends no AERM for aluminum piping, piping components, and piping elements in a controlled indoor air environment.

In LRA Tables 3.3.2-1, 3.3.2-31, and 3.3.2-38, the applicant stated that the copper and copper alloy piping, piping components, piping elements, and tanks exposed to raw water (internal) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. In LRA Table 3.3.2-25, the applicant stated that the copper and copper alloy circulating water pumps exposed to raw water (internal) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. In LRA Table 3.3.2-31, the applicant stated that the copper and copper alloy system strainer screens/elements exposed to raw water (internal) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because GALL Report items VII.H2-11 and VIII.A-4 state that the aging effects for copper exposed to raw water are pitting, crevice, and microbiologically-influenced corrosion.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material and flow blockage. The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material due to pitting, crevice, and microbiologically-influenced corrosion, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

In LRA Tables 3.3.2-1, 3.3.2-36, and 3.3.2-38, the applicant stated that the copper and copper alloy internal surfaces of piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.3.2-27, the applicant stated that the copper and copper alloy external surfaces of motor cooler components exposed to raw water are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.3.2-51, the applicant stated that the copper and copper alloy external surfaces of condensate pump motor cooler components and piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.3.2-54, the applicant stated that the copper and copper alloy external surfaces of normal and emergency nuclear services closed-cycle cooling pump motor cooler components exposed to raw water are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environments. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments, such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.10. The staff determined that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff further determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses.

The staff further noted that a visual examination supplemented by mechanical testing such as scraping or chipping would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air – indoor uncontrolled (external and internal), air – outdoor (external), fuel oil (internal and external), and raw water (internal and external).

In LRA Tables 3.3.2-1, 3.3.2-2, 3.3.2-24, 3.3.2-25, 3.3.2-31, 3.3.2-38, 3.3.2-49, and 3.3.2-50, the applicant stated that carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed all AMR result lines in the GALL Report for this component and material combination and noted that loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion is identified as potential aging effects for steel piping, piping components, and piping elements exposed to raw water. The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the proposed AMP acceptable to manage aging for these components because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic inspections of the component internal surfaces which are capable of detecting loss of material due to various corrosion mechanisms.

In LRA Table 3.3.2-1, the applicant stated that stainless steel piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J. The applicant also cited plant-specific note 319, indicating that the piping associated with these components is part of the miscellaneous drains system.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of loss of material due to pitting, crevice, and microbiologically-influenced corrosion because it performs periodic visual inspections of the internal surfaces of stainless steel piping, piping components, and piping elements that are capable of detecting loss of material and cracking.

By letter dated November 12, 2010, the applicant amended the LRA to include in LRA Tables 3.3.2-1, 3.3.2-4, 3.3.2-5, 3.3.2-6, 3.3.2-7, 3.3.2-8, 3.3.2-9, 3.3.2-10, 3.3.2-11, 3.3.2-12, 3.3.2-13, 3.3.2-15, 3.3.2-19, 3.3.2-20, 3.3.2-21, 3.3.2-22, 3.3.2-24, 3.3.2-25, 3.3.2-27, 3.3.2-32, 3.3.2-36, 3.3.2-38, 3.3.2-42, 3.3.2-50, 3.3.2-51, 3.3.2-52, 3.3.2-54, 3.3.2-55, 3.3.2-56, 3.3.2-57, 3.3.2-60, and 3.3.2-61, AMRs for steel, stainless steel, copper and copper alloy piping, piping components and piping elements exposed to dried air (inside) which are being managed for the loss of material by the Compressed Air Monitoring Program. The AMR items cite generic note J. The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effect for this component, material and environmental combination because the applicant has recognized the possibility of moisture and/or condensation in systems which typically only contain dried air.

The staff's evaluation of the applicant's Compressed Air Monitoring Program is documented in SER Section 3.0.3.1.11. The staff noted that the applicant's Compressed Air Monitoring Program is identified as consistent with no enhancements or exceptions with the GALL Report Compressed Air Monitoring Program. The staff finds the applicant's proposal to manage aging using the Compressed Air Monitoring Program acceptable because steel, stainless steel, copper and copper alloy piping, piping components and piping elements in a dried air environment (with the potential for condensation) would have the same aging effect as the steel compressed air system piping, piping components and piping elements exposed to condensation described in items VII.D-2 and VII.D-4 in the GALL Report, which recognizes loss of material as an aging effect to be managed by the Compressed Air Monitoring Program. On the basis that the LRA components are similar to other GALL Report items for the material and environment, the staff concurs that the effect of dried air (with the potential for condensation) will result in a potential loss of material that can be effectively managed by the Compressed Air Monitoring Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Reactor Building Recirculation System - Summary of Aging Management Review – LRA Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the reactor building recirculation system component groups.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-2, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-15, 3.3.2-16, 3.3.2-17, 3.3.2-22, 3.3.2-27, 3.3.2-49, 3.3.2-51, and 3.3.2-54, the applicant stated that the copper and copper alloy reactor building fan assembly cooling coil and motor cooler components, decay heat closed-cycle pump air supply cooling coil components, spent fuel coolant pump air supply cooling coil components, control complex normal and emergency cooling coil components, reactor building penetration cooling coil components, EFIC room HVAC cooling coil components, Appendix R control complex dedicated room cooler components, piping, piping components, piping elements, tanks, motor cooler components and elements, and normal and emergency nuclear services closed-cycle cooling pump motor cooler components exposed to air – indoor uncontrolled (external) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environment. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments, such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.10. The staff determined that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff further determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses.

The staff further noted that a visual examination supplemented by mechanical testing, would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air – indoor uncontrolled (external and internal), air – outdoor (external), fuel oil (internal and external), and raw water (internal and external).

In LRA Tables 3.3.2-2, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-15, 3.3.2-16, 3.3.2-17, 3.3.2-27, 3.3.2-29, 3.3.2-49, 3.3.2-51, and 3.3.2-54, the applicant stated that the copper and copper alloy reactor building fan assembly cooling coil tubes and motor cooler tubes, decay heat closed-cycle pump air supply cooling coil tubes, spent fuel coolant pump air supply cooling coil tubes, control complex normal and emergency cooling coil tubes, reactor building penetration cooling coils, EFIC room HVAC cooling coil tubes, Appendix R control complex dedicated room cooler tubes, motor cooler tubes, emergency diesel generator air cooler coolant radiator tubes, emergency diesel generator combustion air cooler tubes, emergency diesel generator jacket coolant radiator tubes, EFP-3 aftercooler tubes, EFP-3 gearbox lube oil cooler tubes, EFP-3 radiator tubes, condensate pump motor cooler tubes, and normal and emergency nuclear services closed-cycle cooling pump motor cooler tubes exposed to air – indoor uncontrolled (external) are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified reduction of heat transfer effectiveness due to fouling of heat transfer surfaces as an applicable aging effect for copper and copper alloy heat transfer surfaces exposed to air. The staff also noted that loss of material is also a concern for copper and copper alloys exposed to air and that this aging effect is being managed for these components by other AMR items.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components (and limited scope inspection of outside surfaces) during opportunities created as a result of existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of reduction of heat transfer effectiveness and flow blockage.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that the periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting flow blockage and reduction of heat transfer effectiveness and, therefore, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

In LRA Tables 3.3.2-2, 3.3.2-7, 3.3.2-8, 3.3.2-11, 3.3.2-15, 3.3.2-16, 3.3.2-17, 3.3.2-22, 3.3.2-27, 3.3.2-49, 3.3.2-51, and 3.3.2-54, the applicant stated that the copper and copper alloy reactor building fan assembly cooling coil components and motor cooler components, decay heat closed-cycle pump air supply cooling coil components, spent fuel coolant pump air supply cooling coil components, control complex normal and emergency cooling coil components, reactor building penetration cooling coil components, EFIC room HVAC cooling coil components, Appendix R control complex dedicated room cooler components, piping, piping components, piping elements, motor cooler components, condensate pump motor cooler components, and normal and emergency nuclear services closed-cycle cooling pump motor cooler components exposed to indoor air and uncontrolled air (external) are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to pitting and crevice corrosion as an applicable aging effect for copper and copper alloys exposed to air. The staff also noted that reduction of heat transfer effectiveness due to fouling of heat transfer surfaces is also a concern for copper and copper alloy heat transfer surfaces exposed to air and that this aging effect is being managed for these components by other AMR items.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components (and limited scope inspection of outside surfaces) during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that the periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material and, therefore, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.3 Reactor Building Miscellaneous Ventilation System - Summary of Aging Management Review – LRA Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the reactor building miscellaneous ventilation system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.4 Reactor Building Purge System - Summary of Aging Management Review – LRA Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the reactor building purge system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Auxiliary Building Supply System - Summary of Aging Management Review – LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the auxiliary building supply system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.6 Fuel Handling Area Supply System - Summary of Aging Management Review – LRA Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the fuel handling area supply system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air

Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.7 Decay Heat Closed-Cycle Pump Cooling System-Summary of Aging Management Review–LRA Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the decay heat closed-cycle pump cooling system component groups.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Spent Fuel Coolant Pump Cooling System-Summary of Aging Management Review– LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the spent fuel coolant pump cooling system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.9 Spent Fuel Pit Supply System - Summary of Aging Management Review – LRA Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the spent fuel pit supply system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air

Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.10 Auxiliary Building Exhaust System - Summary of Aging Management Review – LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the auxiliary building exhaust system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Control Complex Ventilation System - Summary of Aging Management Review – LRA Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the control complex ventilation system component groups.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials

Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

LRA Tables 3.3.2-11, 3.3.2-21, 3.3.2-22, 3.3.2-38, 3.3.2-41, 3.3.2-47, and 3.3.2-50 contain items which address hardening and loss of strength due to elastomer/plastic degradation of PVC or thermoplastic ducting, ducting components, piping, piping components, piping elements, tanks, and evaporative cooler components exposed to uncontrolled indoor air, outdoor air, raw water, closed-cycle cooling water, and treated water. The applicant proposed that neither the component nor the material and environment combination is evaluated in the GALL Report (note J). The applicant acknowledges that aging may occur for this combination of materials and environments and proposed to manage it through the use of its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12.

In its review of these items, the staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program contained in the GALL Report is a visual inspection program limited to steel components. The staff also noted that the LRA AMP has been expanded to include: components constructed of materials other than steel; physical manipulation or other investigative methods to detect aging effects; and detection of hardening and changes in material properties. The staff considers the combined use of visual and physical methods proposed by the applicant to be both necessary and sufficient to detect hardening and loss of strength of elastomers and plastics. Therefore, the staff finds the applicant's proposed AMR acceptable.

LRA Tables 3.3.2-11, 3.3.2-21, 3.3.2-22, 3.3.2-38, 3.3.2-41, 3.3.2-47, and 3.3.2-50 contain items which address hardening and loss of strength due to elastomer/plastic degradation of PVC or thermoplastic ducting, ducting components, piping, piping components, piping elements, and tanks exposed to uncontrolled indoor air or outdoor air. The applicant proposed that neither the component nor the material and environment combination is evaluated in the GALL Report (note J). The applicant acknowledges that aging may occur for this combination of materials and environments and proposed to manage it through the use of its External Surfaces Monitoring Program.

In its review of these items, the staff noted that the External Surfaces Monitoring Program contained in the GALL Report is a visual inspection program and that its scope is limited to steel surfaces. The staff also noted that the applicant has committed to enhance its External Surfaces Monitoring Program to include components constructed from materials other than steel and to detect additional aging effects associated with those materials, including hardening and loss of strength. The staff further noted that the applicant has not explicitly committed to enhancing its program to include inspection techniques other than visual inspection and that hardening and loss of strength are not directly detected by visual examinations and that visual changes in elastomers and plastics may, but need not, occur in conjunction with hardening and loss of strength. However, based on a review of the AMR line item tables, the External Surfaces Monitoring Program is complemented in each instance by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program which uses visual as well as physical manipulation and/or testing to verify hardness and loss of strength of the elastomeric material.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs is documented in SER

Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. The staff finds the applicant's proposal to manage aging using both the External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs acceptable because, between the two programs, appropriate visual, physical manipulation, or testing methods will be used to detect aging effects.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-11, 3.3.2-22, and 3.3.2-44, the applicant stated that for glass piping, piping components, and piping elements exposed to dry gas, there is no aging effect and no AMP is proposed. The AMR line items cite generic note J.

The staff finds the applicant's proposal acceptable because the GALL Report identifies no aging effect for glass material exposed to any environment (e.g., lubricating oil, air, treated borated water) and the dry gas environment is less aggressive than the examples in the GALL Report; therefore, no AERMs are expected and no AMP is required.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Emergency Diesel Generator Air Handling System - Summary of Aging Management Review – LRA Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the emergency diesel generator air handling system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Miscellaneous Heating, Ventilation, and Air Conditioning System - Summary of Aging Management Review – LRA Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the miscellaneous HVAC system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.14 Turbine Building Ventilation System - Summary of Aging Management Review – LRA Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the turbine building ventilation system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.15 Penetration Cooling System - Summary of Aging Management Review – LRA Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the penetration cooling system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-15, 3.3.2-28, 3.3.2-38, and 3.3.2-41, the applicant stated that gray cast iron piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal) and fuel oil pumps exposed to fuel oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because GALL Report Section IX.C states only that gray cast iron is susceptible to selective leaching. The staff also noted that all GALL Report line items that are associated with gray cast iron state that the only aging effect is selective leaching and the recommended AMP is GALL AMP XI.M33, "Selective Leaching of Materials." The staff further noted that the inspections required by the applicant's Selective Leaching of Materials Program would also detect any other loss of material aging effects that might occur.

The staff's evaluation of the applicant's Selective Leaching of Materials Program is documented in SER Section 3.0.3.2.10. The staff finds the applicant's proposal to manage aging using the Selective Leaching of Materials Program acceptable because the program includes appropriate hardness/scratch tests and inspections to detect selective leaching and, as documented in LRA Section B.2.10, the applicant discussed plant-specific operating experience in which multiple instances of selective leaching of components in the nuclear services and decay heat sea water system have been detected and corrected by this program.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.16 Emergency Feedwater Initiation and Control Room Heating, Ventilation, and Air Conditioning System - Summary of Aging Management Review – LRA Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the emergency feedwater initiation and control room HVAC system component groups.

In LRA Table 3.3.2-16, the applicant stated that the stainless steel air handling unit housings exposed to raw water are being managed for loss of material due to MIC by the Inspection of

Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line item cites generic note H.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. The applicant stated that its program includes visual inspections of the internal surfaces of steel piping and ducting components during existing preventive maintenance, surveillance testing, and periodic testing work order tasks that provide the opportunity to inspect the internal surfaces of the components. The applicant stated that its program also includes a limited scope of preventive maintenance activities that include physical manipulation testing and inspection of external surfaces. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage aging for this component group because the program performs visual inspections of the internal surfaces of piping and ducting components which are capable of detecting loss of material due to MIC.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.17 Appendix R Control Complex Dedicated Cooling Supply System - Summary of Aging Management Review – LRA Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the Appendix R control complex dedicated cooling supply system component groups.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for loss of material due to pitting and crevice corrosion, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Selective Leaching of Materials

Program for loss of material due to selective leaching, with generic note J, is documented in SER Section 3.3.2.3.2.

In LRA Tables 3.3.2-17, 3.3.2-27, 3.3.2-29, 3.3.2-49, 3.3.2-51, and 3.3.2-54, the applicant proposed to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of aluminum and aluminum-alloy cooler tubes, condenser tubes, aftercooler tubes, and radiator tubes exposed to an indoor uncontrolled air environment (external) using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff noted that the GALL Report in the structures and component supports systems, under item III.B1.1-6, recommends no AERMs for aluminum components exposed to indoor uncontrolled air. The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the credited AMP appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces (and limited scope inspection of outside surfaces) with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces, with generic note J, is documented in SER Section 3.3.2.3.2.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.18 Emergency Feedwater Pump Building Ventilation System - Summary of Aging Management Review – LRA Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the emergency feedwater pump building ventilation system component groups.

In LRA Tables 3.3.2-18, 3.3.2-23, 3.3.2-36, 3.3.2-38, 3.3.2-40, 3.3.2-46, and 3.3.2-50, the applicant stated that the carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) are being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program. In LRA Tables 3.3.2-28 and 3.3.2-36, the applicant stated that the carbon or low alloy steel/stainless steel closure bolting exposed to soil (external) are being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program and loss of material due to galvanic corrosion by the Buried Piping and Tanks Inpsection Program. The AMR line items cite generic note J.

In its review, the staff finds that the Bolting Integrity Program is adequate to manage the loss of preload of the steel/stainless steel bolting exposed to air – outdoor because the applicant's program can manage the loss of preload through the proper selection of bolting and gasket materials, preload control, and compliance with the bolting installation guidance recommended in the GALL Report in addition the GALL Report recommends GALL AMP XI.M18 "bolting Integrity Program," to manage the loss of preload of the steel bolting exposed to air – indoor uncontrolled, which is an environment similar to that of the AMR items.

However, in relation to the closure bolting exposed to soil, the staff noted that the LRA does not provide detailed information on how the Bolting Integrity and Buried Piping and Tanks Inspection programs manages the loss of preload and loss of material of the buried closure bolting components especially in terms of the inspection extent and schedules. The staff also found a need to review relevant operating experience regarding loss of preload and loss of material of the buried closure bolting components and associated leakage, if applicable. By letter dated December 1, 2009, the staff issued RAI 3.3.2.28-1 requesting that the applicant describe how the Bolting Integrity Program manages the loss of preload and loss of material of the buried closure bolting components. The staff also requested that the applicant provide operating experience regarding the loss of preload and loss of material of the buried closure bolting and associated leakage as relevant.

In its response dated December 30, 2009, the applicant stated that the Bolting Integrity Program manages the loss of preload due to thermal effects, gasket creep, and self-loosening in the buried bolting described in LRA Tables 3.3.2-28 and 3.3.2-36. The applicant also stated that its aging management of the loss of preload is consistent with the GALL Report through controls on material selection, using the guidance which NUREG-1339 endorsed on design and installation of bolted connections, control of lubricants, etc. The applicant stated that the Buried Piping and Tanks Inspection Program is credited with managing loss of material of buried bolting in LRA Tables 3.3.2-28 and 3.3.2-36. The applicant further stated that piping specifications required buried fire protection system bolted connections to be coated with a corrosion inhibitor subsequent to installation and prior to backfilling. The applicant also stated that the fuel oil storage tanks are protected from corrosion with an impressed current cathodic protection system.

In addition, the applicant stated that the fuel oil storage tanks and buried fire protection system piping are subject to the inspection requirements of the Buried Piping and Tanks Inspection Program. The applicant stated that the Buried Piping and Tanks Inspection Program provides for as-found pipe coating and material condition inspection whenever buried components within the scope of this license renewal program are exposed, with an overall frequency of inspections not to be less than one every 10 years, consistent with the recommendations of the GALL Report.

The applicant also stated that the fuel oil system buried bolting is limited to several flanged connections at the underground fuel oil tanks (buried fuel oil piping is socket welded). The applicant further stated that the fuel oil storage tanks are regularly monitored and the fuel oil quality is subject to regular sampling and analysis to detect contamination, including water contamination through groundwater intrusion. The applicant stated that the fire protection system buried piping integrity is routinely verified through monitoring of system pressure and jockey pump operation. The staff noted that given the close proximity of the bolted connections to the fuel oil tank, they would be provided with cathodic protection and thus eliminate loss of material, monitoring of water intrusion into the fuel oil storage tanks could provide an indication of groundwater intrusion due to wasted bolting in buried fuel oil flanged joints, and monitoring of fire system pressure and jockey pump operation could provide an indication of loss of integrity of buried fire protection bolted joints.

The applicant stated that loss of preload due to thermal effects, gasket creep, and self-loosening of buried bolted connections was not identified in CR-3 operating experience reviews. In terms of operating experience with the buried piping of the fuel oil tanks, the applicant stated:

> A review of plant OE did identify an instance wherein fuel oil sampling activities identified potential water intrusion in Fuel Oil Storage Tank DFT-1A. Subsequent investigative activities included disassembly of the manway flanged connections, which are not buried, but are located above the tank in an access pit. Inspection of the gasket flange faces, showed no evidence of leakage, and the manway was reassembled with new gaskets. While the source of the water identified was not ascertained, no additional indications of water intrusion were noted. It was reasoned that the previous indications of water intrusion may have been due to undetected water during a fuel delivery or to leakage of water that had seeped into the access pit through the gasket on the manway cover.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.28-1 acceptable because the applicant credited the Bolting Integrity Program and Buried Piping and Tanks Inspection Program, which are consistent with the GALL Report, to manage the loss of preload and loss of material, respectively. In the buried bolting, the fire protection system piping is coated with a corrosion inhibitor, which can prevent or mitigate the loss of material in the soil environment. The inspection frequency for the buried piping of the fire protection system and the fuel oil storage tanks is consistent with the recommendation of GALL AMP XI.M34, "Buried Piping and Tanks Inspection." The regular monitoring of the fuel oil quality can detect potential intrusion of the groundwater through the buried bolting of the fuel oil system piping and mitigate the potential effect of water contamination on the loss of material in the closure bolting. The applicant's review of the operating experience indicates no incidence of leakage from the buried bolting, and the operating experience also indicates that the aging management methodology of proposed can adequately detected water contamination in the fuel oil and performed corrective actions, which was adequate to confirm the integrity of the manway bolting in the access pit. The staff's concern described in RAI 3.3.2.28-1 is resolved.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to acceptable because the applicant's program manages loss of preload through the proper selection of bolting and gasket materials, preload control, and compliance with the bolting installation guidance recommended in the GALL Report.

The staff's evaluation for carbon or low alloy steel emergency feedwater pump diesel engine exhaust piping, piping components, piping elements, standpipes, hydrants, tanks, and expansion joints exposed to diesel exhaust which are being managed for loss of material due to general, crevice, and pitting corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-18, 3.3.2-23, 3.3.2-38, 3.3.2-40, 3.3.2-43, 3.3.2-46, 3.3.2-50, 3.4.2-2, and 3.4.2-13, the applicant stated that carbon, low alloy steel, and galvanized steel diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting, and containment isolation piping and components exposed to air – outdoor (external) are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program. The AMR line items cite generic note H.

The staff reviewed AMR line items in the GALL Report where the material and environment includes steel piping and other external surfaces exposed to outdoor air and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that there are several AMR line items in the GALL Report for this combination (i.e., items V.E-8, VII.I-9, and VIII.H-8) which recommend managing loss of material due to general, pitting, and crevice corrosion using GALL AMP XI.M36, "External Surfaces Monitoring."

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The applicant stated that the External Surfaces Monitoring Program performs visual examinations of the external surfaces of the above listed components for evidence of corrosion, material loss, and leakage. The staff finds the applicant's proposal acceptable because the External Surfaces Monitoring Program performs inspections capable of detecting loss of material due to pitting and crevice corrosion.

The staff's evaluation for stainless steel expansion joints exposed to diesel exhaust which are being managed for loss of material due to pitting and crevice corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to diesel exhaust and treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.19 Chemical Addition System - Summary of Aging Management Review – LRA Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarizes the results of AMR evaluations for the chemical addition system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR in LRA Table 3.3.2-19 for stainless steel piping, piping elements, piping components, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for stainless steel piping, piping components, piping elements, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.20 Liquid Sampling System - Summary of Aging Management Review – LRA Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarizes the results of AMR evaluations for the liquid sampling system component groups.

LRA Tables 3.3.2-20, 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-27, 3.3.2-33, 3.3.2-42, 3.3.2-53, 3.3.2-54, and 3.3.2-57 contain items addressing piping insulation exposed to outdoor air or uncontrolled indoor air. The AMR line items cite generic note J. The applicant further proposed that this combination of environment and material is not subject to aging and that no AMP is required.

In its review of these items, the staff noted that, depending on the application, piping insulation may be fabricated from many materials. These materials commonly include polymeric foams, inorganic fibers, and solid ceramics. The staff also noted that the applicant did not state the type of insulation which was being used, the material of the pipe over which it was being applied, or the range of temperatures expected at the interface between the pipe and the insulation. The staff further noted that some types of insulation (e.g., polymeric foams) are subject to aging and may require aging management. Finally, the staff noted that the combined use of some forms of insulation and piping materials in some environments (e.g., chloride containing insulation over stainless steel pipe in humid environments) may create additional aging effects in the piping material.

By letter dated December 1, 2009, the staff issued RAI 3.2.2.3-1 requesting that the applicant provide sufficient information concerning the type of insulation being used, the type of pipe over which it will be applied, the compatibility between the insulation and the pipe, and whether the presence of condensation or other moisture is possible, to allow the staff to conclude whether the insulation is subject to aging or whether the use of the insulation will result in unexpected aging of the pipe material.

In its response dated December 30, 2009, the applicant stated that insulation materials used at the station include mineral fiber, calcium silicate, fiberglass, elastomeric foam, glass wool, and stainless steel reflective jacketing and, based upon an operating experience review for an indoor air uncontrolled environment, there are no AERMs. The applicant also stated that prevention of condensation is addressed by insulation specifications including installing an appropriate thickness of the material and insulating pipe supports on piping systems where the system temperature is below ambient air temperatures. The applicant further stated that each batch of insulation installed in the reactor building was tested for chlorides, sodium, and silicate consistent with the insulation specifications.

Based on its review, the staff finds the applicant's response acceptable because none of the insulation materials are susceptible to aging with the exception of elastomeric foam, but given its jacketing, it will not be exposed to high levels of ultraviolet light. Additionally, specifications controlled insulation installation to minimize the potential of condensation being formed between the insulation and pipe material and testing was conducted on insulation material to ensure that leachable elements would not impact the piping. The staff's concern described in RAI 3.2.2.3-1 is resolved.

LRA Table 3.3.2-20 contains items addressing fiberglass or fiber-reinforced plastic piping, piping components, and piping elements exposed to dry gas. The AMR line items cite generic note J. The applicant further proposed that this combination of environment and material is not subject to aging and that no AMP is required.

In its review of these items, the staff noted that, in the GALL Report, the term gas is defined as dry air and inert or nonreactive gases. The GALL Report further limits the use of the term gas to situations where aging and the need for aging management are not expected. The LRA defines the terms gas and dry air in accordance with the GALL Report. Based on these definitions, the staff finds the applicant's proposal that an AMP is not required for this combination of material and environment acceptable.

LRA Tables 3.3.2-20, 3.3.2-38, and 3.3.2-50 contain items which address hardening and loss of strength due to elastomer/plastic degradation of fiberglass or fiber-reinforced plastic piping, piping components, piping elements, and tanks exposed to uncontrolled indoor air or raw water. The AMR line items cite generic note J. The applicant acknowledged that aging may occur for this combination of materials and environments and proposed to manage it through the use of its External Surfaces Monitoring Program (reviewed in SER Section 3.0.3.2.11).

In its review of these items, the staff noted that the External Surfaces Monitoring Program contained in the GALL Report is a visual inspection program and that its scope is limited to steel surfaces. The staff also noted that the applicant has committed to enhance its External Surfaces Monitoring Program to include components constructed from materials other than steel and to detect additional aging effects associated with those materials, including hardening and loss of strength. The staff further noted that the applicant has not explicitly committed to enhancing its program to include inspection techniques other than visual inspection. Lastly, the staff noted that hardening and loss of strength are not directly detected by visual examinations and that visual changes in elastomers and plastics may, but need not, occur in conjunction with hardening and loss of strength. However, for the components in LRA Tables 3.3.2-38 and 3.3.2-50, the External Surfaces Monitoring Program is complemented in each instance by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program which uses visual as well as physical manipulation and/or testing to verify hardness and loss of strength of the elastomeric material.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because GALL Report Section IX.E states that hardening and loss of strength are the only applicable aging effects for elastomeric components.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs is documented in SER Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. The staff finds the applicant's proposal to manage aging using both the External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs acceptable because, between the two programs, appropriate visual, physical manipulation, or testing methods will be used to detect aging effects. For fiberglass or fiber-reinforced plastic piping components exposed to dry gas on the interior and uncontrolled indoor air in LRA Table 2.3.2-20, the staff finds the applicant's proposal acceptable because the potential for aging is very low, physical manipulation does not provide any more input related to hardening and loss of strength for the associated components (i.e., piping, piping components, and piping elements), and visual inspections would detect any surface degradation or sagging of pipe which would be indicative of hardening and loss of strength.

In LRA Tables 3.3.2-20, 3.3.2-21, 3.3.2-24, 3.3.2-25, 3.3.2-31, 3.3.2-34, 3.3.2-38, 3.3.2-52, 3.3.2-55, 3.3.2-57, 3.3.2-60, and 3.3.2-61, the applicant stated that stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample coolers exposed to raw water are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion; flow blockage due to fouling; and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for these component, material, and environment combinations because GALL Report items V.E-34 and V.EP-55 cite loss of material due to pitting, crevice, and microbiologically-influenced corrosion for this material and environment combination. In addition, flow blockage due to fouling is a potential consequence for strainer screens and elements due to the potential for debris contained in raw water. Also, cracking due to SCC is a potential consequence for stainless steel components in the potential temperatures to which they are being exposed in the liquid sampling and post-accident sampling systems.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of loss of material, flow blockage, and cracking because it performs periodic inspections of the internal surfaces of stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample coolers that are capable of detecting these aging effects.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.21 Post-Accident Liquid Sampling System - Summary of Aging Management Review – LRA Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarizes the results of AMR evaluations for the post-accident liquid sampling system component groups.

The staff's evaluation for nickel-alloy components exposed to treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-21, the applicant stated that nickel-alloy post-accident sampling system cooler components exposed to treated water (internal) are being managed for cracking due to SCC, loss of material due to crevice and pitting corrosion, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Water Chemistry Program. The AMR line items cite generic note J.

The GALL Report, under item V.A-16, recommends the use of the Water Chemistry Program and One-Time Inspection Program to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces for stainless steel heat exchanger tubes in a treated water environment, in order to provide measures to verify the effectiveness of the Water Chemistry Program.

By letter dated December 1, 2009, the staff issued RAI 3.3.2.21-1 requesting that the applicant provide details as to why the One-Time Inspection Program is not needed to verify the effectiveness of water chemistry control in managing the aging effect of reduction of heat transfer effectiveness due to fouling of heat transfer surfaces in the nickel-based alloy components.

In its response dated December 30, 2009, the applicant stated that the One-Time Inspection Program will supplement the Water Chemistry Program for this AMR line item. The applicant also stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited to manage the aging effects of loss of material due to crevice, pitting, and microbiologically-influenced corrosion and cracking due to SCC of nickel-alloy post-accident sampling system cooler components exposed to raw water (internal). The applicant also stated that nickel-alloy post-accident sampling system cooler tubes exposed to raw water (internal) are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.21-1 acceptable because the applicant amended its LRA to credit its One-Time Inspection Program, which includes appropriate NDE examinations, in order to verify the effectiveness of its Water Chemistry Program in managing these nickel-alloy components subject to loss of material and cracking. The staff's concern described in RAI 3.3.2.21-1 is resolved.

The staff's review of the Water Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff finds the applicant's Water Chemistry Program acceptable because it requires periodic monitoring and controlling of water chemistry for impurities (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion and cracking. The staff finds that controlling the water chemistry creates an environment that is not conducive for corrosion and cracking to occur. Furthermore, the applicant's One-Time Inspection Program will perform an appropriate NDE examination to detect loss of material and cracking to verify the effectiveness of its chemistry control.

The staff's review of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of loss of material due to crevice, pitting, and microbiologically-influenced corrosion, cracking due to SCC, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces because it performs periodic NDE inspections appropriate for the loss of material and cracking during preventive maintenance, surveillance testing, and periodic testing work order tasks that will provide opportunities for the examinations of internal surfaces of piping and ducting components. The staff noted that this program includes appropriate NDE inspections, such as visual inspections to detect loss of material and enhanced visual (VT-1 or equivalent) and/or volumetric (RT or UT) to detect cracking due to SCC.

In LRA Table 3.3.2-21, the applicant stated that nickel-alloy post-accident sampling system cooler components exposed to closed-cycle cooling water (external) are being managed for loss of material due to crevice and pitting corrosion and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Closed-Cycle Cooling Water System Program. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report where the component and material combination is nickel-alloy components exposed to closed-cycle cooling water and confirmed that the applicant has identified the correct aging effects for this combination. The staff confirmed that there are no entries for this material and environment combination. However, the staff noted that nickel alloys have similar aging effects as stainless steels when exposed to water and that there are several line items in the GALL Report (e.g., item VII.C2-3) for stainless steel components exposed to closed-cycle cooling water which recommend GALL AMP XI.M21, "Closed-Cycle Cooling Water," to manage loss of material and reduction of heat transfer.

The staff's review of the Closed-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.4. The staff noted that controlling closed cooling water chemistry creates an environment that is not conducive for loss of material. The staff finds the applicant's proposed AMP acceptable because it includes addition of system corrosion inhibitors to minimize corrosion and fouling, inspections which are capable of detecting loss of material and fouling, and surveillance testing which will evaluate system and component performance to verify the effectiveness of the chemistry control.

By letter dated December 30, 2009, the applicant submitted LRA Amendment No. 8 which included AMR items in LRA Table 3.3.2-21 for stainless steel containment isolation piping and components and piping, piping components, piping elements, and tanks exposed to raw water (internal) which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample coolers components exposed to raw water and which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water, which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.11.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.22 Control Complex Chilled Water System - Summary of Aging Management Review – LRA Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarizes the results of AMR evaluations for the control complex chilled water system component groups.

The staff's evaluation for glass piping, piping components, and piping elements exposed to dry gas, with generic note J, is documented in SER Section 3.3.2.3.11.

In LRA Tables 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-29, 3.3.2-48, 3.3.2-51, 3.3.2-52, and 3.3.2-54, the applicant stated that the internal surfaces of elastomers in expansion joints, piping, piping components, piping elements, and tanks exposed to uncontrolled indoor air, closed-cycle cooling water, and raw water are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that the LRA AMP has been expanded from the corresponding GALL Report AMP to include materials other than steel and test methods other than visual. The staff also noted that the LRA AMP includes elastomers and includes physical manipulation and other investigative methods designed specifically to detect hardening and loss of strength in elastomers. The staff finds the applicant's proposed use of this AMP to manage the aging effects for these AMR line items acceptable because the program will be capable of detecting the aging effect under consideration and appropriate inspection techniques are included in the program.

In LRA Tables 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-29, 3.3.2-48, 3.3.2-51, 3.3.2-52, and 3.3.2-54, the applicant stated that the external surfaces of elastomers in expansion joints, piping, piping components, piping elements, and tanks exposed to outdoor air and uncontrolled indoor air are being managed for hardening, loss of strength, and loss of material due to wear by the External Surfaces Monitoring Program. The AMR line items cite generic note J. The staff noted that the GALL Report (items V.B-4, VII.F1-6, and VII.F1-7) recommends evaluation of a plant-specific AMP to manage hardening and loss of strength for elastomers exposed to indoor uncontrolled air. The staff also noted that in LRA Table 3.3.2-48, the elastomeric components are exposed to uncontrolled indoor air on both the external and internal surfaces and the applicant proposed to use the External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs to manage aging effects.

In its review of these items, the staff noted that the applicant has committed to enhancing its External Surfaces Monitoring Program to include additional materials and to enhance program procedures to detect hardening and loss of strength of elastomers. The staff also noted that detection of hardening and loss of strength of elastomers generally requires some form of mechanical or manual interaction with the elastomer and that the External Surfaces Monitoring Program is generally a visual inspection program. By letter dated December 1, 2009, the staff issued RAI B.2.23.2-1 requesting that the applicant confirm that the enhancements proposed for the External Surfaces Monitoring Program will specifically include physical manipulation and other investigative methods designed specifically to detect hardening and loss of strength in elastomers.

In its response dated December 30, 2009, the applicant stated that the External Surfaces Monitoring Program has been credited for performing visual inspections. The applicant also stated that its aging management strategy for elastomers considers that physical manipulation may be required to detect hardening and loss of strength. The applicant further stated in its response to RAI B.2.23-1 that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program augments visual inspections for the inside surfaces of elastomers with physical manipulation to verify that hardening and loss of strength is not occurring for elastomers. The applicant stated that physical manipulation includes, "...scratching the material surface to screen for residues that may indicate a breakdown of the polymer material, bending or folding of the component which may indicate surface cracking, stretching to evaluate resistance of the polymer material, and pressing on the material to evaluate the resiliency."

The staff determined that additional information was required to evaluate the applicant's response because the aging effects of hardening and loss of strength for polymeric materials can, depending on the environment to which it is exposed, initiate on either the internal or external surface of the component. Given that some components may be thick or rigid, it was not clear to the staff how mechanically inspecting a component from the interior surface alone will detect hardening or loss of strength which may initiate on the external surface. Additionally, unless the External Surfaces Monitoring Program contains some requirements for the manual manipulation of polymeric materials, the staff was unsure how the applicant plans to specifically provide for the manual inspection of polymeric materials which are inspected only from the outside. By letter dated May 21, 2010, the staff issued RAI B.2.23.2-1.1 requesting that the applicant describe how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will detect hardening and loss of strength which originates on the outside surfaces of polymeric materials and describe how the inspection of polymeric materials only from the outside is addressed.

In its response dated June 21, 2010, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program directs the inspection activities that include physical manipulation during preventive maintenance activities when the component is taken out of service and both surfaces are available for inspection. The applicant also stated that the External Surfaces Monitoring Program visual inspections are augmented by the physical manipulation inspections conducted by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.

The staff finds the applicant's response acceptable because both surfaces of the components will be available for physical manipulation inspections conducted by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the applicant stated that the components will be visually inspected by the External Surfaces Monitoring Program in conjunction with the physical manipulation inspections, and the staff reviewed the polymeric line items in LRA Tables 3.3.2-22, 3.3.2-23, 3.3.2-24, 3.3.2-25, 3.3.2-29, 3.3.2-48, 3.3.2-51, 3.3.2-52, and 3.3.2-54, and found that both programs are used to manage the aging effects of hardening and loss of strength due to elastomer/plastic degradation in all cases. The staff's concern described in RAI B.2.23.2-1.1 is resolved.

The staff reviewed the applicant's External Surfaces Monitoring and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs and its evaluations are documented in SER Sections 3.0.3.2.11 and 3.0.3.1.12, respectively. The staff finds the applicant's proposed use of these AMPs to manage the aging effects for these AMR line items acceptable because the elastomeric materials will be visually inspected and physically manipulated on both the interior and exterior surfaces and as such, the aging effects of hardening and loss of strength can be detected.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed by the External Surfaces Monitoring Program for hardening and loss of strength, with generic note J, is documented in SER Section 3.3.2.3.11.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.23 Appendix R Chilled Water System - Summary of Aging Management Review – LRA Table 3.3.2-23

The staff reviewed LRA Table 3.3.2-23, which summarizes the results of AMR evaluations for the Appendix R chilled water system component groups.

In LRA Tables 3.3.2-23, 3.3.2-28, and 3.3.2-50, the applicant stated that aluminum and aluminum-alloy condenser components, piping, piping elements, and tanks exposed to outdoor air (external) are being managed for loss of material due to crevice and pitting corrosion and aluminum and aluminum-alloy condenser components exposed to outdoor air are being managed for reduction of heat transfer effectiveness due to fouling by the External Surfaces Monitoring Program. The AMR items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because GALL Report item VII.F1.AP-142 addresses the loss of material due to crevice and pitting corrosion for comparable components exposed to condensation. The staff noted that GALL Report Section IX.D defines outdoor air as being potentially moist, which is sufficiently similar to a condensation environment to expect comparable aging effects. In addition, GALL Report Section IX.F states that reduction in heat transfer due to fouling can be due to an accumulation of deposits on heat exchanger tubing, and the staff noted that the potential for particulate and other debris in outdoor air provides a sufficient basis for postulating this aging effect. The staff further noted that SCC of this material in outdoor air was addressed by separate AMR items.

The staff reviewed the applicant's External Surfaces Monitoring Program, which is evaluated in SER Section 3.0.3.2.11. The staff finds the credited AMP appropriate because the External Surfaces Monitoring Program requires periodic inspections and monitoring of the component external surface to manage the aging effects of fouling and loss of material due to general, pitting, and crevice corrosion.

In LRA Tables 3.3.2-23, 3.3.2-28, and 3.3.2-50, the applicant stated that the aluminum condenser components, piping, piping elements, and tanks exposed to outdoor air (external) are being managed for cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR items cite generic note J.

The staff noted in American Society for Metals (ASM) Handbook, Volume 13A, “Corrosion: Fundamentals, Testing and Protection,” that certain grades of aluminum alloy are susceptible to SCC in moist environments. The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because the GALL Report Section IX.D defines outdoor air as being potentially moist, which could lead to the effect described in the ASM Handbook. The staff also noted that loss of material due to pitting and crevice corrosion of this material in outdoor air was addressed by separate AMR items.

The staff’s evaluation of the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant’s response to RAI B.2.23-1 clarified the capability of this AMP to detect SCC through visual inspections. The staff also noted that this AMP includes preventive maintenance activities to inspect external surfaces even though its title would imply that it only pertained to internal surfaces. The staff finds the credited AMP acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program uses periodic work order tasks to inspect components and uses enhanced visual and/or volumetric inspection methods which are able to detect SCC, as recommended in GALL AMP XI.M32.

In LRA Tables 3.3.2-23, 3.3.2-25, 3.3.2-27, 3.3.2-31, 3.3.2-38, 3.3.2-49, and 3.3.2-51, the applicant stated that the copper and copper alloy Appendix R control complete chiller air cooled condenser components; circulating water pumps, piping, piping components, piping elements, and tanks; and system strainer screens/elements exposed to air – outdoor and air – indoor uncontrolled (external) are being managed for loss of material due to pitting and crevice corrosion and Appendix R control complete chiller air cooled condenser tubes exposed to air – outdoor (external) are being managed for reduction of heat transfer effectiveness due to fouling by the External Surfaces Monitoring Program. The AMR line items cite generic note J.

The staff reviewed the AMR result lines in the GALL Report where the material and environment is copper alloys exposed to uncontrolled air and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that there are no entries for copper alloys exposed to outdoor air, but that the GALL Report (item VIII.I-2) recommends that copper alloy piping exposed to indoor uncontrolled air has no AERMs. The staff also noted that aging effects in outdoor air are generally due to intermittent wetting, and the GALL Report (item VII.F1-16) recommends evaluation of a plant-specific AMP to manage loss of material for copper alloy components exposed to outdoor air.

The staff reviewed the applicant’s External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The staff noted that this program includes visual examinations performed during system inspections and walkdowns. The staff determined that surfaces that are inaccessible during plant operations are inspected during refueling outages and includes measures to provide assurance that aging effects are managed on surfaces that are inaccessible during both plant operations and refueling outages. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material and reduction of heat transfer due to fouling. On the basis of its review, the staff finds that because this program includes a periodic visual inspection which is capable of detecting loss of material and reduction of heat transfer effectiveness due to fouling, this program will adequately manage these aging effects when these components are exposed to air – outdoor (external) and air – indoor uncontrolled (external).

In LRA Tables 3.3.2-23, 3.3.2-25, 3.3.2-31, 3.3.2-36, and 3.3.2-38, the applicant stated that the copper and copper alloy Appendix R control complex chiller air cooled condenser components; circulating water pumps and piping, piping components, piping elements, and tanks; system strainer screens/elements; and sprinkler heads and spray nozzles exposed to air – outdoor (external) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environment. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.10. The staff noted that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff further determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses.

The staff further noted that a visual examination supplemented by mechanical testing, such as scraping or chipping, would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air-indoor uncontrolled (external and internal), air-outdoor (external), fuel oil (internal and external), and raw water (internal and external).

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which are being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.24 Industrial Cooling System - Summary of Aging Management Review – LRA Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarizes the results of AMR evaluations for the industrial cooling system component groups.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.25 Circulating Water System - Summary of Aging Management Review – LRA Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarizes the results of AMR evaluations for the circulating water system component groups.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) which are being managed for loss of material due to selective leaching by the

Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.23.

In LRA Table 3.3.2-25 the applicant stated that reinforced concrete piping, piping components, and piping elements exposed to raw water are being managed for change in material properties, cracking, and loss of material due various degradation mechanisms by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material and environmental combination because the applicant proposes to inspect for change in material properties, cracking, and loss of material, thus encompassing all known aging effects for reinforced concrete pipe exposed to flowing raw water.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of change in material properties, cracking and loss of material because it performs periodic visual inspections of the internal surfaces of reinforced concrete piping, piping components, and piping elements that are capable of detecting changes in material properties (evidenced by effects such as spalling, voids, etc.), loss of material and cracking in concrete.

LRA Tables 3.3.2-25 and 3.3.2-49 contain items for reinforced concrete piping exposed to a soil environment which are being managed for changes in material properties, cracking, and loss of material by the Structures Monitoring Program. The applicant proposed that neither the component nor the material and environment combination is evaluated in the GALL Report (note J). The applicant also stated in note 303 that, "Buried Nuclear Service and Decay heat Sea Water System and Circulating Water System conduits are constructed of prestressed concrete with a steel liner. External concrete surfaces of this piping will be managed by inspections under the Structures Monitoring Program."

In its review of these items, the staff noted that the applicant's Structures Monitoring Program includes enhancements to inspect inaccessible surfaces of reinforced concrete pipe when exposed due to removal of backfill for any reason. However, based on recent industry operating experience, the staff was concerned that this approach may not be adequate for aging management of buried concrete piping within the scope of license renewal. Therefore, by letter dated July 8, 2010, the staff issued RAI B.2.22-2 requesting that the applicant explain how the AMPs used in managing the aging of buried, underground, and limited access piping within the scope of license renewal will address recent industry operating experience. This issue is being addressed in SER Section 3.0.3.1.10 which includes a more detailed discussion of the RAI, as well as the applicant's response and the staff's review and acceptance.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-25, the applicant stated that the copper and copper alloy piping, piping components, piping elements, and tanks exposed to raw water (internal) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed all AMR line items in the GALL Report where the material and environment includes copper alloy components exposed to raw water and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that there are several AMR line items in the GALL Report for this combination (e.g., items VII.C3-2, VII.C1-9, and VII.G-12) which recommend managing the components for loss of material due to pitting, crevice, and microbiologically-influenced corrosion. In addition to these aging effects, the applicant noted that the components are susceptible to cracking.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. The staff also noted that this program contains inspection techniques such as enhanced visual (VT-1 or equivalent) and/or volumetric (RT or UT) which are capable of detecting cracking due to SCC and are an acceptable means to detect cracking due to SCC, as recommended by the GALL Report. On the basis of its review, the staff finds that because the periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material and cracking, this program will adequately manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC when these components are exposed to raw water.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.2.2.3.1.

By letter dated July 22, 2009, the applicant submitted Amendment No. 1 to the LRA, which added an AMR result to LRA Table 3.3.2-25 for fiberglass or fiber-reinforced plastic piping, piping components, piping elements, and tanks exposed to air – indoor uncontrolled (external) which are being managed for hardening and loss of strength due to elastomer/plastic degradation by the External Surfaces Monitoring Program. The AMR line items cite generic note J. The staff's evaluation for fiberglass or fiber-reinforced plastic components exposed to uncontrolled air managed by the External Surfaces Monitoring Program for loss of strength due to elastomer/plastic degradation, with generic note J, is documented in SER Section 3.3.2.3.20.

By letter dated July 22, 2009, the applicant submitted Amendment No. 1 to the LRA, which added an AMR result to LRA Table 3.3.2-25 for fiberglass or fiber-reinforced plastic piping, piping components, piping elements, and tanks exposed to raw water (internal) which are being managed for hardening and loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for fiberglass and fiber-reinforced plastic components exposed to uncontrolled indoor air and open-cycle cooling water or raw water which are being managed for hardening and loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.49.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.26 Emergency Feedwater Pump No. 3 Diesel Air Starting System-Summary of Aging Management Review–LRA Table 3.3.2-26

The staff reviewed LRA Table 3.3.2-26, which summarizes the results of AMR evaluations for the EFP-3 diesel air starting system component groups.

In LRA Tables 3.3.2-26, 3.3.2-33, 3.3.2-38, 3.3.2-40, 3.3.2-44, and 3.3.2-50, the applicant stated that carbon or low alloy steel piping, piping components, piping elements, tanks, system strainers, emergency feedwater pump and emergency diesel generator starting air receivers, and containment isolation piping exposed to indoor-uncontrolled air (interal) are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff noted that LRA Tables 3.3.2-26, 3.3.2-33, 3.3.2-38, 3.3.2-40, 3.3.2-44, and 3.3.2-50 contain additional line items for carbon or low alloy steel piping, piping components, piping elements, tanks, system strainers, emergency feedwater pump and emergency diesel generator starting air receivers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion. The line items cite generic note A and C. The staff also noted that all known corrosion mechanisms for carbon or low alloy steel exposed to indoor uncontrolled air have been addressed by these multiple line items.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the proposed AMP acceptable to manage aging for these components because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic inspections of the component internal surfaces which are capable of detecting loss of material due to various corrosion mechanisms and flow blockage due to fouling.

In LRA Table 3.3.2-26, the applicant stated that the copper and copper alloy piping, piping components, and piping elements exposed to air-indoor uncontrolled (internal) are being managed for loss of material due to pitting and crevice corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material and flow blockage.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material, flow blockage, and reduction of heat transfer effectiveness, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

In LRA Table 3.3.2-26, the applicant stated that the copper and copper alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.3.2-33, the applicant stated that the copper and copper alloy piping, piping components, piping elements, and tanks exposed to air – indoor uncontrolled (internal) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environment. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.10. The staff determined that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff further determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses.

The staff further noted that a visual examination supplemented by mechanical testing, such as scraping or chipping, would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air – indoor uncontrolled (external and internal), air – outdoor (external), fuel oil (internal and external), and raw water (internal and external).

In LRA Tables 3.3.2-26, 3.3.2-38, 3.3.2-55, and 3.3.2-56, the applicant stated that stainless steel piping, piping components, piping elements, containment isolation piping, tanks, and system strainers exposed to indoor air are being managed for loss of material due to crevice or pitting corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant’s proposed AMP acceptable to manage the aging effects of loss of material and flow blockage because it performs periodic visual inspections of the internal surfaces of stainless steel piping, piping components, piping elements, tanks, and strainers that are capable of detecting loss of material and flow blockage.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.27 Decay Heat Closed-Cycle Cooling System-Summary of Aging Management Review–LRA Table 3.3.2-27

The staff reviewed LRA Table 3.3.2-27, which summarizes the results of AMR evaluations for the decay heat closed-cycle cooling system component groups.

The staff’s evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff’s evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.2.

In LRA Tables 3.3.2-27 and 3.3.2-49, the applicant stated that the copper and copper alloy motor cooler components exposed to raw water (external) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. In LRA Tables 3.3.2-51 and 3.3.2-54, the applicant stated that the copper and copper alloy condensate pump motor cooler components and the normal and emergency nuclear services closed-cycle cooling pump motor cooler components, respectively, exposed to raw water (external) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material and flow blockage.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material, flow blockage, and reduction of heat transfer effectiveness, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

The staff's evaluation for copper and copper alloy components exposed to raw water (internal or external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for aluminum and aluminum alloy cooler tubes exposed to an indoor uncontrolled air environment which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.17.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum and aluminum alloy piping, piping components, piping elements, and tanks exposed to a dried air environment with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.28 Fuel Oil System - Summary of Aging Management Review – LRA Table 3.3.2-28

The staff reviewed LRA Table 3.3.2-28, which summarizes the results of AMR evaluations for the fuel oil system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to soil (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

In LRA Tables 3.3.2-28, 3.3.2-36, and 3.3.2-49, the applicant stated that carbon steel or low alloy steel tanks; carbon steel, low alloy steel, or cast iron piping, piping components, and piping elements; and carbon, low alloy, or stainless steel bolts exposed to soil are being managed for loss of material due to galvanic corrosion by the Buried Piping and Tanks Inspection Program. The AMR line items cite generic notes H or J.

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.1.10. The staff noted that the most probable galvanic couple for these items is a stainless steel bolt in a carbon steel or cast iron pipe flange, which will create a galvanic couple and result in galvanic corrosion. The staff also noted that while the expected rate of this corrosion is greater than that expected for steel or cast iron, it is less than the rate that may occur for microbiologically-influenced corrosion. The staff further noted that given that the basis for the inspection frequency of the piping systems includes microbiologically-influenced corrosion, it would, therefore, envelope the necessary inspection frequency for galvanic corrosion. The staff finds the applicant's proposal to manage aging using the Buried Piping and Tanks Inspection Program acceptable because the inspection techniques used for the detection of general, crevice, and pitting corrosion will also detect galvanic corrosion and the galvanic corrosion rate is not expected to exceed that of microbiologically-influenced corrosion.

The staff's evaluation for gray cast iron piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal) and fuel oil pumps exposed to fuel oil which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.15.

The staff's evaluation for aluminum and aluminum alloy piping, piping components, piping elements, and tanks exposed to outdoor air (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for aluminum and aluminum alloy piping, piping components, piping elements, and tanks exposed to outdoor air (external) which are being managed for cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.23.

In LRA Tables 3.3.2-28 and 3.3.2-36, the applicant stated that the copper and copper alloy piping, piping components, piping elements, tanks, system strainers, standpipes, and hydrants exposed to fuel oil (internal and external) are being managed for cracking due to SCC by the Fuel Oil Chemistry Program supplemented by its One-Time Inspection Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified cracking due to SCC as being an applicable aging effect for copper and copper alloys exposed to a fuel oil environment. The staff noted that one potential cause for SCC is the presence of ammonia or nitrogen in conjunction with moisture and oxygen. The staff also noted that fuel oil systems have the potential to contain contaminants including water in stagnant locations where copper and copper alloy may be susceptible to cracking due to SCC.

The staff reviewed the applicant's Fuel Oil Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.9, respectively. The staff noted that the Fuel Oil Chemistry Program includes periodic sampling and testing of fuel oil in accordance with ASTM Standards and the plant's TS surveillance requirements. The staff also noted that in LRA Section B.2.19, the applicant stated that periodic sampling of fuel oil and the addition of a biocide, a stabilizer, and corrosion inhibitors will minimize exposure to fuel oil contaminants, such as water and microbiological organisms.

The staff noted that the applicant's One-Time Inspection Program will also verify the effectiveness of its Fuel Oil Chemistry Program. On the basis of its review, the staff finds that cracking due to SCC for these components will be adequately managed because contaminants such as water, microbiological organisms, and particulates that can promote corrosion and cracking will be controlled by the Fuel Oil Chemistry Program, which will be supplemented by the One-Time Inspection Program to confirm the effectiveness of the Fuel Oil Chemistry Program.

In LRA Table 3.3.2-28, the applicant stated that the copper and copper internal surfaces of piping, piping components, piping elements, and tanks and internal and external surfaces of system strainers exposed to fuel oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.3.2-36, the applicant stated that the copper and copper alloy internal surfaces of piping, piping components, standpipes, hydrants, and tanks exposed to fuel oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environment. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.2.10. The staff noted that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses.

The staff further noted that a visual examination supplemented by mechanical testing, such as scraping or chipping, would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air – indoor uncontrolled (external and internal), air – outdoor (external), fuel oil (internal and external), and raw water (internal and external).

In LRA Tables 3.3.2-28 and 3.3.2-48, the applicant stated that stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program for the external surfaces of the components and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for the internal surfaces of the components. The AMR line items cite generic note J.

The staff reviewed the applicant's External Surfaces Monitoring Program and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluations are documented in SER Sections 3.0.3.2.11 and 3.0.3.1.12, respectively. The applicant indicated that the External Surfaces Monitoring Program performs periodic visual inspections of components subject to loss of material. Similarly, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program prescribes periodic visual inspections to identify loss of material. The staff finds the applicant's External Surfaces Monitoring Program and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs acceptable to manage loss of material due to crevice or pitting corrosion of stainless steel components exposed to outdoor air because visual inspection is an acceptable technique to detect these aging effects.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.29 Jacket Coolant System - Summary of Aging Management Review – LRA Table 3.3.2-29

The staff reviewed LRA Table 3.3.2-29, which summarizes the results of AMR evaluations for the jacket coolant system component groups.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for aluminum and aluminum alloy cooler tubes exposed to an indoor uncontrolled air environment which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.17.

In LRA Tables 3.3.2-29 and 3.3.2-30, the applicant proposed to manage loss of material due to crevice and pitting corrosion and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of aluminum cooler components and tubes exposed to lubricating oil with the Lubricating Oil Analysis Program and the One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because GALL Report item VII.H1-1 identifies loss of material due to crevice and pitting corrosion of aluminum components exposed to a fuel oil environment, which will promote similar aging effects to a lubricating oil environment. In addition, GALL Report item VIII.G-8 identifies loss of heat transfer due to fouling for copper heat exchanger components, which would similarly be applicable to aluminum cooler components and tubes.

The staff reviewed the applicant's Lubricating Oil Analysis Program and the One-Time Inspection Program, which are evaluated in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. The staff finds that the credited AMPs are appropriate because these programs provide for periodic sampling of lubricating oil to maintain contaminants not exceeding the levels conducive to loss of material or reduction in heat transfer and use one-time inspections of select components in the system to verify the effectiveness of the Lubricating Oil Analysis Program.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.30 Diesel Generator Lube Oil System - Summary of Aging Management Review – LRA Table 3.3.2-30

The staff reviewed LRA Table 3.3.2-30, which summarizes the results of AMR evaluations for the diesel generator lube oil system component groups.

The staff's evaluation for aluminum and aluminum alloy piping, piping components, and piping elements exposed to lubricating oil which are being managed for loss of material due to crevice and pitting corrosion by the Lubricating Oil Analysis Program and the One-Time Inspection Program, with generic note J, is documented in SER Section 3.3.2.3.29.

In LRA Tables 3.3.2-30, 3.3.2-39, and 3.3.2-42, the applicant stated that stainless steel piping components, expansion joints, drip pans, and strainers exposed to lubricating oil are being managed for cracking due to SCC and flow blockage due to fouling by the Lubricating Oil Analysis Program and the One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed the associated AMR items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because the other potential aging effects for this material in this environment, including loss of material due to crevice and pitting corrosion, in GALL Report item VII.H2-17, are included in the LRA.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. The applicant stated that the Lubricating Oil Analysis Program provides for periodic sampling and analysis of lubricating oil to maintain the concentration of contaminants within acceptable limits and that the One-Time Inspection Program will perform visual inspections of components exposed to lubricating oil to confirm the effectiveness of the Lubricating Oil Analysis Program. The staff noted that a one-time inspection is an acceptable method to determine whether or not cracking or flow blockage is occurring. The staff finds the applicant's proposed combination of programs acceptable to manage cracking due to SCC and flow blockage due to fouling of stainless steel components exposed to lubricating oil because the programs will limit the concentrations of contaminants in the lubricating oil and use visual inspections to verify the effectiveness of the program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.31 Domestic Water System - Summary of Aging Management Review – LRA Table 3.3.2-31

The staff reviewed LRA Table 3.3.2-31, which summarizes the results of AMR evaluations for the domestic water system component groups.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.20.

In LRA Tables 3.3.2-31 and 3.3.2-49, the applicant stated that stainless steel piping, piping components, piping elements, tanks, cyclone separators, flow-restricting orifice housings and plates, nuclear service and decay heat sea water pumps, and nuclear services and decay heat sea water pump strainer screens and elements exposed to indoor air are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program. The applicant cited generic note J.

The staff reviewed the AMR line items in the GALL Report where the component and material is stainless steel piping, piping components, piping elements, tanks, cyclone separators, flow-restricting orifice housings and plates, nuclear service and decay heat sea water pumps, and nuclear services and decay heat sea water pump strainer screens and elements exposed to indoor air and noted that the GALL Report states that there is no aging effect and no AMP is recommended.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The applicant stated that this program prescribes periodic visual inspections of components subject to aging effects. The staff finds the applicant's External Surfaces Monitoring Program acceptable to manage the loss of material due to crevice and pitting corrosion of stainless steel components exposed to indoor air because visual inspection is an acceptable technique to detect this aging degradation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.32 Demineralized Water System-Summary of Aging Management Review–
LRA Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarizes the results of AMR evaluations for the demineralized water system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.33 Emergency Diesel Generator System-Summary of Aging Management Review–
LRA Table 3.3.2-33

The staff reviewed LRA Table 3.3.2-33, which summarizes the results of AMR evaluations for the emergency diesel generator system component groups

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to diesel exhaust and treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Tables 3.3.2-33 and 3.4.2-7, the applicant stated that carbon or low alloy steel diesel exhaust silencers and piping, piping components, piping elements, and tanks exposed to air – outdoor (external) are being managed for loss of material due to galvanic corrosion by the External Surfaces Monitoring Program. The AMR line items cite generic note H.

The GALL Report, under item VII.H1-8, for steel piping, piping components, and piping elements exposed to air – outdoor (external) recommends the External Surfaces Monitoring Program for loss of material due to general, pitting, and crevice corrosion. In LRA Table 3.3.2-33, the applicant proposed to use the External Surfaces Monitoring Program. The staff noted that galvanic corrosion occurs when there is contact between dissimilar metals which may not be detected by visual examination. By letter dated December 1, 2009, the staff issued RAI 3.3.2.33-1 requesting that the applicant clarify how the External Surfaces Monitoring Program could be used to manage loss of material due to galvanic corrosion.

In its response dated December 30, 2009, the applicant stated that the External Surfaces Monitoring Program will be used to inspect for galvanic corrosion where carbon steel and stainless steel are in contact in outdoor (wetted) environments and that the galvanic corrosion between carbon and stainless steel manifests itself as externally visible rust. The applicant also stated that if loss of material due to galvanic corrosion did not manifest itself as rust, the corrosion would be insignificant and would not pose a liability to the component's intended function. The staff finds the applicant's response acceptable because the GALL Report recognizes galvanic corrosion as an aging effect for steel components, which could take place when carbon steel is in contact with stainless steel in an external wetted environment, which is detectable through periodic visual inspections. The staff's concern described in RAI 3.3.2.33-1 is resolved.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The staff finds the applicant's proposed AMP acceptable to manage the aging effects for these AMR line items because the program will perform visual inspections which are capable of detecting galvanic corrosion between carbon and stainless steel components and will include inspections on both carbon or low alloy steel and stainless steel components.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for emergency feedwater pump and emergency diesel generator starting air receivers, piping, piping components, piping elements, tanks, system strainers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.26.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

In LRA Table 3.3.2-33, the applicant stated that the copper and copper alloy piping, piping components, piping elements, and tanks exposed to air – indoor uncontrolled (internal) are being managed for loss of material due to pitting, crevice corrosion, and selective leaching by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the Selective Leaching of Materials Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for the component, material, and environment combination because the technical literature notes that condensate from uncontrolled indoor air could lead to pitting, crevice corrosion, and selective leaching (ASM Handbook (2005), Volume 13B – Corrosion: Materials). LRA Table 3.0-1 states that uncontrolled indoor air may contain significant amounts of moisture that can lead to water pooling. The staff noted that selective leaching occurs only in highly alloyed copper, such as bronzes and brasses. The GALL Report notes this by applying the Selective Leaching of Materials Program to copper alloys with greater than 15 percent Zn. LRA Table 3.3.2-33 does not specifically identify copper alloys with greater than 15 percent Zn; however, the applicant has addressed aging due to selective leaching for the same components in other AMR line items in LRA Table 3.3.2-23.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff also noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (internal) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.26.

In LRA Tables 3.3.2-33, 3.3.2-59, and 3.3.2-60, the applicant stated that stainless steel piping, piping components, piping elements, containment isolation piping, tanks, and system strainers exposed to indoor air are being managed for loss of material due to crevice or pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed all the AMR result lines in the GALL Report where the component and material is stainless steel piping, piping components, piping elements, containment isolation piping, tanks, and system strainers exposed to indoor air and noted that the GALL Report states that there is no aging effect and no AMP is recommended.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The applicant stated that this program prescribes periodic visual inspections to identify loss of material. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage loss of material due to crevice and pitting corrosion of stainless steel components exposed to indoor air because visual inspection is an acceptable technique to detect this aging degradation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.34 Floor Drains System-Summary of Aging Management Review–LRA Table 3.3.2-34

The staff reviewed LRA Table 3.3.2-34, which summarizes the results of AMR evaluations for the floor drains system component groups.

In LRA Tables 3.3.2-34, 3.3.2-38, 3.3.2-47, 3.3.2-49, and 3.3.2-52, the applicant stated that carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument air receivers, and tanks exposed to raw water are being managed for flow blockage and reduction of heat transfer effectiveness due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because the other potential aging effects for this material in this environment, which include loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion, are addressed by GALL Report item VII.F2-3 and are addressed in the LRA for these components.

In LRA Table 3.3.2-34, the applicant stated that the copper and copper alloy piping, piping components, and piping elements exposed to raw water (internal) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report where the material and environment includes copper alloy components exposed to raw water and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that there are several AMR line items in the GALL Report for this combination (e.g., items VII.C3-2, VII.C1-9, and VII.G-12) which recommend managing the components for loss of material due to pitting, crevice, and microbiologically-influenced corrosion. In addition to these aging effects, the GALL Report (item VII.C1-6) also recommends managing reduction of heat transfer due to fouling for copper alloy heat exchanger components exposed to raw water, which is equivalent to managing flow blockage due to fouling.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff determined that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material and flow blockage.

The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material, flow blockage, and reduction of heat transfer effectiveness, this program will adequately manage these aging effects when these components are exposed to the environments listed above.

In LRA Tables 3.3.2-34 and 3.3.2-52, the applicant stated that gray cast iron piping, piping components, and piping elements exposed to raw water are being managed for flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report where the material and environment includes gray cast iron components exposed to raw water and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that the GALL Report, in Table IX.C, states that gray cast iron is susceptible to selective leaching and considers gray cast iron to be steel for the purposes of the AMR for aging effects other than selective leaching. The staff also noted that GALL Report item V.C-5 states that steel is susceptible to loss of material and fouling when exposed to raw water. The staff noted that the applicant is managing selective leaching and loss of material for these components in other AMR line items in the same table.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The applicant indicated that this program will perform periodic visual inspections which are capable of identifying flow blockage. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage flow blockage due to fouling for gray cast iron components exposed to raw water because visual inspection is an acceptable technique to manage this aging degradation.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.35 Fuel Handling System - Summary of Aging Management Review – LRA Table 3.3.2-35

The staff reviewed LRA Table 3.3.2-35, which summarizes the results of AMR evaluations for the fuel handling system component groups.

In LRA Table 3.3.2-35, the applicant stated that there is no aging effect for stainless steel containment isolation piping and components exposed to indoor air and, therefore, no AMP is credited. The applicant cited generic note J.

The staff reviewed the AMR line items in the GALL Report and noted that items IV.E-2, V.F-12, VII.J-15, and VIII.I-10 for stainless steel piping and piping components exposed to indoor air state that there is no aging effect and no AMP is recommended. The staff finds the applicant's proposal acceptable because it is consistent with the GALL Report.

In LRA Table 3.3.2-35, the applicant stated that stainless steel containment isolation piping and components exposed to treated water are being managed for cracking due to SCC by the Water Chemistry Program. The applicant cited generic note J. The applicant also cited plant-specific note 302 stating that operating experience indicated that the stainless steel fuel pool liner and related components exposed to the same environment are susceptible to SCC.

The staff reviewed the GALL Report section on fuel pool liners under item III.A5-13, which recommends the use of GALL AMP XI.M2, "Water Chemistry," to manage the effects of SCC for stainless steel fuel pool liners. The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The applicant stated that this program controls the concentration of impurities in treated water in accordance with EPRI Water Chemistry Guidelines in order to mitigate the effects of aging. The staff finds the applicant's proposal to use the Water Chemistry Program to manage SCC of stainless steel components exposed to treated water acceptable because it is consistent with GALL Report item III.A5-13 for the fuel pool liner and the components discussed are made of the same material and are in the same environment as the fuel pool liner.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.36 Fire Protection System-Summary of Aging Management Review– LRA Table 3.3.2-36

The staff reviewed LRA Table 3.3.2-36, which summarizes the results of AMR evaluations for the fire protection system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to soil (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon or low alloy steel tanks; carbon steel, low alloy steel, or cast iron piping, piping components, and piping elements; and carbon, low alloy, or stainless steel bolts exposed to soil which are being managed for loss of material due to galvanic corrosion by the Buried Piping and Tanks Inspection Program, with generic notes H and J, is documented in SER Section 3.3.2.3.28.

In LRA Table 3.3.2-36, the applicant stated that stainless steel system strainers and containment isolation piping and piping components; stainless steel, copper and copper alloy, piping, piping components, standpipes, hydrants, and tanks; and copper and copper alloy sprinkler heads and spray nozzles exposed to fire water or outdoor air are being managed for loss of material due to galvanic, crevice, pitting, and microbiologically-influenced corrosion and hardening and loss of strength due to elastomer plastic degradation by the Fire Water System Program. The staff evaluated the material properties of stainless steel, carbon steel, low alloy steel, copper, and copper alloys and noted that the materials generally perform satisfactorily in fire water, fuel oil, and outdoor air environments without excessive corrosion or loss of strength due to plastic degradation.

The staff reviewed the applicant's Fire Water System Program and its evaluation is documented in SER Section 3.0.3.2.7. The staff noted that the applicant's Fire Water System Program includes system pressure monitoring, wall thickness evaluations, flow and pressure testing, and visual examinations to assess fire water system equipment condition. The staff also noted that the applicant committed (Commitment No. 9) to evaluate the fire water system piping thickness and visually examine the piping internals prior to entering the period of extended operation. The staff further noted that loss of material due to galvanic, crevice, pitting, and microbiologically-influenced corrosion and the plastic degradation of PVC water pipe can be adequately detected by wall thickness evaluations and visual inspection. The staff finds the applicant's Fire Water System Program acceptable to manage the effects of loss of material and hardening and loss of strength for the fire protection system components discussed above because the proposed program performs periodic visual inspections and determines wall thickness.

The applicant stated that carbon and low alloy steel piping, piping components, standpipes, hydrants, and tanks exposed to fuel oil are being managed for loss of material due to MIC and flow blockage due to fouling by the Fire Protection and Fuel Oil Chemistry programs. The AMR line items site generic note J.

The staff reviewed the applicant's Fire Protection and Fuel Oil Chemistry programs and its evaluations are documented in SER Sections 3.0.3.2.6, and 3.0.3.2.8, respectively. The staff noted that the applicant's Fuel Oil Chemistry Program includes testing of fuel quality in accordance with ASTM standards prescribed in the applicant's TSs and addition of biocide and corrosion inhibitors. The staff also noted that the applicant routinely conducts the fire diesel operability test under its Fire Protection Program. The staff finds the applicant's Fuel Oil Chemistry and Fire Protection programs acceptable to control loss of material due to microbiologically-influenced corrosion and flow blockage due to fouling for those fire protection system components discussed that are exposed to fuel oil because it monitors the fuel oil for contaminants and performs periodic testing of the fire diesel.

In LRA Table 3.3.2-36, the applicant stated that the carbon or low alloy steel fire service water storage tanks exposed to outdoor air are being managed for loss of material due to galvanic corrosion by the Aboveground Steel Tanks Program. The LRA cites generic note J.

The staff reviewed AMR line items in the GALL Report where the material and environment includes carbon steel tanks exposed to outdoor air and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that GALL Report item VII.H1-11 recommends managing carbon steel tanks exposed to outdoor air for loss of material due to general, pitting, and crevice corrosion. The staff also noted that the applicant has identified galvanic corrosion as an additional aging effect for this component.

The staff reviewed the applicant's Aboveground Carbon Steel Tanks Program, and its evaluation is documented in SER Section 3.0.3.1.8. The staff finds the proposed AMP acceptable because the Aboveground Carbon Steel Tanks Program requires periodic inspections of the tank external surfaces which can detect loss of material due to corrosion.

The staff's evaluation for carbon or low alloy steel emergency feedwater pump diesel engine exhaust piping, piping components, piping elements, standpipes, hydrants, tanks, and expansion joints exposed to diesel exhaust which are being managed for loss of material due to general, crevice, and pitting corrosion using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-36, the applicant stated that carbon or low alloy steel piping, piping components, standpipes, hydrants, and tanks exposed to fuel oil are being managed for loss of material due to microbiologically influenced corrosion by the Fire Protection and the Fuel Oil Chemistry programs. The AMR line items cite generic note J.

The staff reviewed all AMR result lines in the GALL Report for this component and material combination and noted that item VII.H1-10 recommends the use of the Fuel Oil Chemistry Program and the One-Time Inspection Program to manage the aging effect of loss of material due to microbiologically influenced corrosion for steel components exposed to a fuel oil environment. It is not clear to the staff how the Fuel Oil Chemistry Program provides adequate aging management for this aging effect in these components.

By letter dated December 1, 2009, the staff issued RAI 3.3.2.36-3 requesting that the applicant provide details as to why the One-Time Inspection Program is not needed to verify the effectiveness of fuel oil chemistry control in managing the aging effect of loss of materials due to microbiologically-influenced corrosion of the steel components. In its response, dated December 30, 2009, the applicant stated that a combination of the Fire Protection, Fuel Oil Chemistry, and One-Time Inspection programs will be credited for the AMR line item. The staff finds the applicant's response acceptable because the One-Time Inspection Program is credited, in addition to the Fuel Oil Chemistry Program, which is consistent with the recommendations in the GALL Report. The staff's concern described in RAI 3.3.2.36-3 is resolved.

The staff reviewed the applicant's Fire Protection, Fuel Oil Chemistry, and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.6, 3.0.3.2.8 and 3.0.3.1.9, respectively. The staff finds the applicant's proposed AMPs acceptable to manage aging for these components because the Fuel Oil Chemistry Program monitors and controls contaminants in the fuel oil and the One-Time Inspection Program performs inspections to verify the effectiveness of the Water Chemistry Program, which is consistent with the recommendations in the GALL Report.

In LRA Table 3.3.2-36, the applicant stated that carbon or low alloy steel piping, piping components, standpipes, hydrants, and tanks exposed to fuel oil are being managed for flow blockage due to fouling by the Fuel Oil Chemistry, Fire Protection, and the One-Time Inspection programs. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report for this component and material combination and noted that in the emergency core cooling system in the GALL Report, under item V.D2-1, the Fuel Oil Chemistry Program augmented by the One-Time Inspection Program are recommended to manage fouling of steel piping, piping components, piping elements, and tanks exposed to fuel oil. The staff reviewed the applicant's Fuel Oil Chemistry Program and the One-Time Inspection Program, which is evaluated in SER Sections 3.0.3.2.8 and 3.0.3.1.9, respectively. The staff finds the proposed AMPs acceptable to manage aging for these components because the Fuel Oil Chemistry Program monitors for and controls contaminants in the fuel oil and the One-Time Inspection Program performs inspections to verify the effectiveness of the Fuel Oil Chemistry Program, which is consistent with the GALL Report recommendations.

In LRA Table 3.3.2-36 and 3.3.2-43, the applicant stated that carbon or low alloy steel piping, piping components, standpipes, hydrants, steel ducting closure bolting, and tanks exposed to outdoor air are being managed for loss of material due to general, crevice, galvanic, and pitting corrosion by the External Surfaces Monitoring Program. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report for this component and material combination and noted that in the diesel fuel oil system under item VII.H1-8, the External Surfaces Monitoring Program a recommended to manage loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to outdoor air. The staff reviewed the applicant's External Surfaces Monitoring Program, which is evaluated in SER Section 3.0.3.2.11. The staff finds the proposed AMP acceptable to manage aging for these components because the External Surfaces Monitoring Program requires periodic inspections and monitoring of the component external surface which is capable of detecting loss of material due to various corrosion mechanisms.

The staff's evaluation for copper and copper alloy components exposed to fuel oil (internal and external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.28.

In LRA Table 3.3.2-36, the applicant stated gray cast iron piping, piping components, standpipes, hydrants, and tanks exposed to outdoor air are being managed for loss of material due to galvanic, crevice, and pitting corrosion by the External Surfaces Monitoring Program. The AMR line item cites generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for the component, material, and environment combination because the technical literature (ASM Handbook (2003), Volume 13A – Corrosion: Fundamentals, Testing, and Protection; ASM Handbook (2005), Volume 13B – Corrosion: Materials) notes that galvanic, crevice, and pitting corrosion of gray cast iron can occur in outdoor air. The staff noted that LRA Table 3.0-1 states that outdoor air is subject to periodic wetting and drying and may contain salt. The staff also noted that galvanic corrosion can occur when gray cast iron is wetted and in contact with metals that are more noble or more corrosion-resistant, such as stainless steels and copper alloys. The staff further noted that crevice and pitting corrosion of gray cast iron is favorable in the presence of chlorides, as found in salt water atmospheres.

The staff reviewed the External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The applicant indicated that this program will perform periodic visual inspections of components subject to aging effects. The staff finds the External Surfaces Monitoring Program acceptable to manage loss of material due to galvanic, crevice or pitting corrosion for gray cast iron components exposed to outdoor air because visual inspection is an appropriate technique to manage this aging degradation.

LRA Table 3.3.2-36 contains items which address hardening and loss of strength due to elastomer/plastic degradation of PVC or thermoplastic piping, piping components, standpipes, hydrants, and tanks exposed to fire water on the inside and soil on the outside. The applicant cited note J for these items. The applicant acknowledged that aging may occur for this combination of materials and environments and proposed to manage the internal surfaces through the use of its Fire Water System Program (reviewed in SER Section 3.0.3.2.7) and does not propose an AMP for the external surfaces.

In its review of these items, the staff noted that hardening and loss of strength of PVC and thermoplastics are not directly detected by visual examinations and that visual changes in elastomers and plastics may, but need not, occur in conjunction with hardening and loss of strength. The staff also noted that hardening and loss of strength of PVC and thermoplastic materials need not be accompanied by a change in wall thickness. The staff further noted that the fire water system program contained in the GALL Report is designed to detect changes in pipe wall thickness through visual inspections and other means but does not contain any test method which will directly assess hardening or loss of strength.

By letter dated December 1, 2009, the staff issued RAI 3.3.2.36-1 requesting that the applicant justify how the proposed AMP will detect changes in hardness and strength of the plastic components under consideration or propose an AMP which will directly measure these changes. The staff noted that PVC and thermoplastics could describe a range of materials that may react differently when exposed to soil. Therefore, by letter dated December 1, 2009, the staff issued RAI 3.3.2.36-2, requesting the applicant clarify what materials are addressed by the AMR item for PVC and thermoplastics exposed to soil in LRA Table 3.3.2-36.

In its response dated December 30, 2009, the applicant stated that in reviewing the line item, it determined that the portion of the fire protection system that included PVC piping is associated with the fire services system from its adjacent fossil plants and were originally included within scope due to the potential impact of leakage from these portions of the piping system on the applicant's fire protection system. The applicant also stated that this portion of the piping system is isolated from the applicant's fire protection system by a normally closed valve and check valve. The applicant further stated that it has deleted this AMR line item from its LRA.

The staff finds the removal of PVC and thermoplastics from the components requiring an aging management review in the fire protection system appropriate because the components do not have a license renewal intended function.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for copper and copper alloy components exposed to fuel oil (internal and external) which are being managed for cracking due to SCC by the Fuel Oil Chemistry Program and One-Time Inspection Program, with generic note J, is documented in SER Section 3.3.2.3.28.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.37 Hydrogen Supply System-Summary of Aging Management Review–LRA Table 3.3.2-37

The staff reviewed LRA Table 3.3.2-37, which summarizes the results of AMR evaluations for the hydrogen supply system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.38 Instrument Air System-Summary of Aging Management Review–LRA Table 3.3.2-38

The staff reviewed LRA Table 3.3.2-38, which summarizes the results of AMR evaluations for the instrument air system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

In LRA Table 3.3.2-38, the applicant stated that gray cast iron piping, piping components, piping elements, and tanks exposed to indoor air are being managed for loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report where the material and environment includes gray cast iron components exposed to indoor air and confirmed that the applicant has identified the correct aging effects for this combination. The staff noted that the GALL Report, in Table IX.C, states that gray cast iron is susceptible to selective leaching and considers gray cast iron to be steel for the purposes of the AMR for aging effects other than selective leaching. The staff also noted that there are several items in the GALL Report (e.g., item V.E-7) which state that steel is susceptible to loss of material when exposed to indoor air. The staff further noted that the applicant is managing selective leaching for these components in other AMR line items in the same table.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The applicant indicated that this program will perform periodic visual inspections which are capable of identifying loss of material. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage loss of material for gray cast iron components exposed to indoor air because visual inspection is an acceptable technique to manage this aging degradation.

In LRA Table 3.3.2-38, the applicant stated that carbon or low alloy steel evaporative cooler coils exposed to closed-cycle cooling water are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces using the Closed-Cycle Cooling Water System Program. The AMR line items cite generic note J.

The staff reviewed AMR line items in the GALL Report for this component and material combination and noted that in other systems in the GALL Report (e.g., GALL item VII.F1-13), reduction of heat transfer due to fouling of steel heat exchanger tubes exposed to closed-cycle cooling water is managed by the Closed-Cycle Cooling Water System Program. The staff reviewed the applicant's Closed-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.4. The staff finds the proposed AMP acceptable to manage aging for these components because the Closed-Cycle Cooling Water System Program includes preventive measures to minimize corrosion and surveillance testing and inspections to monitor the effects of corrosion on the components.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument air receivers, and tank elements exposed to raw water which are being managed for flow blockage and reduction of heat transfer effectiveness due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.34.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-38, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited to manage loss of material due to crevice, pitting, and microbiologically-influenced corrosion of aluminum piping, piping components, piping elements, and tanks exposed to raw water.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds that the credited AMP is appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

The staff's evaluation for emergency feedwater pump and emergency diesel generator starting air receivers, piping, piping components, piping elements, tanks, system strainers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.26.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to raw water (internal or external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) which are being managed for loss of material due to selective leaching by the

Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.23.

The staff's evaluation for fiberglass or fiber-reinforced plastic components exposed to uncontrolled air or raw water which are being managed for loss of strength due to elastomer/plastic degradation by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for gray cast iron piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal) and fuel oil pumps exposed to fuel oil which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.15.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and system strainers exposed to indoor air which are being managed for loss of material or flow blockage by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.26.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.2.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.39 Reactor Coolant Pump Lube Oil Collection System-Summary of Aging Management Review–LRA Table 3.3.2-39

The staff reviewed LRA Table 3.3.2-39, which summarizes the results of AMR evaluations for the reactor coolant pump lube oil collection system component groups.

The staff's evaluation for stainless steel piping components and drip pans exposed to a lubricating oil environment which are managed for cracking due to SCC by the Lubricating Oil

Analysis and One-Time Inspection programs, with generic note J, is documented in SER Section 3.3.2.3.30.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.40 Leak Rate Test System-Summary of Aging Management Review–
LRA Table 3.3.2-40

The staff reviewed LRA Table 3.3.2-40, which summarizes the results of AMR evaluations for the leak rate test system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for emergency feedwater pump and emergency diesel generator starting air receivers, piping, piping components, piping elements, tanks, system strainers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.26.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.41 Miscellaneous Drains System-Summary of Aging Management Review–
LRA Table 3.3.2-41

The staff reviewed LRA Table 3.3.2-41, which summarizes the results of AMR evaluations for the miscellaneous drains system component groups.

The staff's evaluation for gray cast iron piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal) and fuel oil pumps exposed to fuel oil which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.15.

In LRA Tables 3.3.2-41 and 3.4.2-1, the applicant stated that gray cast iron piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff noted that both LRA Tables 3.3.2-41 and 3.4.2-1 contain additional line items for gray cast iron piping, piping components, piping elements, and tanks exposed to raw water which are being managed for selective leaching of materials and crevice, general, and pitting corrosion. The line items cite generic notes C and D. The staff also noted that all known corrosion mechanisms for gray cast iron exposed to raw water have been addressed by these multiple line items.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The applicant stated that this program will perform periodic visual inspections to identify loss of material. The staff finds the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage loss of material due to MIC for gray cast iron components exposed to raw water because visual inspection is an acceptable technique to manage this aging degradation.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.11.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.42 Makeup and Purification System-Summary of Aging Management Review-
LRA Table 3.3.2-42

The staff reviewed LRA Table 3.3.2-42, which summarizes the results of AMR evaluations for the makeup and purification system component groups.

The staff's evaluation for stainless steel strainers exposed to a lubricating oil environment which are being managed for cracking due to SCC and flow blockage due to fouling by the Lubricating Oil Analysis and One-Time Inspection programs, with generic note J, is documented in SER Section 3.3.2.3.30.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.43 Miscellaneous Mechanical and Structure System-Summary of Aging Management Review-LRA Table 3.3.2-43

The staff reviewed LRA Table 3.3.2-43, which summarizes the results of AMR evaluations for the miscellaneous mechanical and structure system component groups.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon or low alloy steel piping, piping components, standpipes, hydrants, steel ducting closure bolting, and tanks exposed to outdoor air which are being managed for loss of material due to general, crevice, galvanic, and pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.36.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.44 Nitrogen Supply System-Summary of Aging Management Review–LRA Table 3.3.2-44

The staff reviewed LRA Table 3.3.2-44, which summarizes the results of AMR evaluations for the nitrogen supply system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for emergency feedwater pump and emergency diesel generator starting air receivers, piping, piping components, piping elements, tanks, system strainers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.26.

The staff's evaluation for glass piping, piping components, and piping elements exposed to dry gas, with generic note J, is documented in SER Section 3.3.2.3.11.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.45 Penetration Cooling Auxiliary System-Summary of Aging Management Review– LRA Table 3.3.2-45

The staff reviewed LRA Table 3.3.2-45, which summarizes the results of AMR evaluations for the penetration cooling auxiliary system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.3.2.3.46 Reactor Building Airlock System - Summary of Aging Management Review – LRA Table 3.3.2-46

The staff reviewed LRA Table 3.3.2-46, which summarizes the results of AMR evaluations for the reactor building airlock system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.47 Roof Drains System-Summary of Aging Management Review–LRA Table 3.3.2-47

The staff reviewed LRA Table 3.3.2-47, which summarizes the results of AMR evaluations for the roof drains system component groups.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument air receivers, and tank elements exposed to raw water which are being managed for flow blockage and reduction of heat transfer effectiveness due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.34.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.11.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.48 Radiation Monitoring System-Summary of Aging Management Review–LRA Table 3.3.2-48

The staff reviewed LRA Table 3.3.2-48, which summarizes the results of AMR evaluations for the radiation monitoring system component groups.

In LRA Table 3.3.2-48, the applicant stated that carbon or low alloy steel piping, piping components, and piping elements exposed to indoor or outdoor (on the inside surfaces of the component) uncontrolled air are being managed for loss of material due to general, crevice, and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff further noted that the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes visual inspection of the external and internal surfaces of components and, therefore, is capable of detecting the effects of aging for both the internal and external surfaces of components. The staff finds the proposed AMP acceptable to manage aging of these components because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic inspections of component internal and external surfaces which are capable of detecting loss of material due to various corrosion mechanisms and fouling.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for stainless steel piping, piping components, piping elements, and tanks exposed to indoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program for the external surfaces of the components and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for the internal surfaces of the components, with generic note J, is documented in SER Section 3.3.2.3.22.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.49 Nuclear Service and Decay Heat Sea Water System-Summary of Aging Management Review–LRA Table 3.3.2-49

The staff reviewed LRA Table 3.3.2-49, which summarizes the results of AMR evaluations for the nuclear service and decay heat sea water system component groups.

In LRA Table 3.3.2-49, the applicant stated that the external surfaces of elastomers in expansion joints exposed to uncontrolled indoor air are being managed for hardening and loss of strength by the Open-Cycle Cooling Water System Program. The AMR line item cites generic note J.

In its review of these items, the staff noted that the applicant's Open-Cycle Cooling Water System Program has been enhanced from the corresponding GALL Report AMP to include periodic maintenance of nuclear services and decay heat sea water expansion joints. The staff also noted that the Open-Cycle Cooling Water System Program relies on procedures established by GL 89-13 and that this GL only addresses issues associated with the interaction of the inner surface of pipes and untreated water. The staff further noted that neither the Open-Cycle Cooling Water System Program nor the GL contain test methods suitable for identifying hardening or loss of strength of elastomers. By letter dated December 1, 2009, the staff issued RAI 3.3.2.49-1 requesting that the applicant explain why it is appropriate to use the proposed AMP to manage aging and how the proposed AMP will adequately accomplish that task.

In its response dated December 30, 2009, the applicant stated that the Open-Cycle Cooling Water System Program for these expansion joints includes periodic preventive maintenance activities that incorporate visual inspection of external and internal surfaces and durometer testing to verify hardening and loss of strength have not occurred. The staff finds the applicant's response acceptable because the program includes testing that will detect loss of strength and hardening in the elastomeric material.

The staff reviewed the applicant's Open-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.3. The staff finds the applicant's proposed use of this AMP to manage the aging effects for these AMR line items acceptable because it provides visual and physical testing of the elastomeric material sufficient to detect the aging effects.

In LRA Table 3.3.2-49, the applicant stated that reinforced concrete piping, piping components, and tanks exposed internally to open-cycle cooling water are being managed for change in material properties, cracking, and loss of material due to various degradation mechanisms by the Open-Cycle Cooling Water System Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because, as explained in plant-specific note 303, the associated piping components are constructed of prestressed concrete with a steel liner and the applicant is managing the liner portion for loss of material due to various mechanisms consistent with GALL Report item VII.C1-19. In addition, based on the plant-specific operating experience regarding degradation of the protective lining in piping spools, the underlying concrete may be exposed to the aggressive sea water environment, which could lead to the cited aging effects including changes in material properties, cracking, and loss of material.

The staff's evaluation for the applicant's Open-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.3. The staff finds the applicant's proposal to manage aging using the Open-Cycle Cooling Water System Program acceptable because exposure of the concrete piping's inside surface to the aggressive sea water environment can only occur if the steel liner or elastomeric expansion joints have degraded, and degradation of the concrete can be identified at the same time that these other problems are found.

The staff's evaluation for concrete piping and pipe components exposed to soil which are being managed for change in material properties, cracking, and loss of material due to various degradation mechanisms by the Structures Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.25.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.27.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for carbon or low alloy steel tanks; carbon steel, low alloy steel, or cast iron piping, piping components, and piping elements; and carbon, low alloy, or stainless steel bolts exposed to soil which are being managed for loss of material due to galvanic corrosion by the Buried Piping and Tanks Inspection Program, with generic notes H and J, is documented in SER Section 3.3.2.3.28.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

LRA Tables 3.3.2-25, 3.3.2-49, and 3.3.2-50 contain fiberglass or fiber-reinforced plastic piping, piping components, piping elements, and tanks exposed to uncontrolled indoor air and open-cycle cooling water or raw water being managed for hardening and loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components. The applicant cited generic note J. The staff noted that GALL Report Sections IX.E and IX.F jointly state that the appropriate aging effect for elastomeric materials is hardening and loss of strength.

In its review of these items, the staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program contained in the GALL Report is a visual inspection program limited to steel components. The staff also noted that the LRA AMP has been expanded to include components constructed of materials other than steel, physical manipulation or other investigative methods to detect aging effects, and detection of hardening and changes in material properties. The staff finds the applicant's proposal acceptable because the combined use of visual and physical methods proposed by the applicant are sufficient for detecting hardening and loss of strength of elastomers and plastics.

The staff's evaluation for aluminum and aluminum alloy cooler tubes exposed to an indoor uncontrolled air environment which are managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.17.

The staff's evaluation for stainless steel cyclone separators, flow orifice pumps, and strainer screens exposed to an indoor uncontrolled air environment which are managed for loss of material due to crevice and piping corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.31.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.50 Station Air System-Summary of Aging Management Review–LRA Table 3.3.2-50

The staff reviewed LRA Table 3.3.2-50, which summarizes the results of AMR evaluations for the station air system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and silencers exposed to outdoor air which are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.2.2.3.1.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited to manage internal surface loss of material due to crevice, pitting, and microbiologically-influenced corrosion of aluminum piping, piping components, piping elements, and tanks exposed to raw water and SCC of aluminum piping, piping components, piping elements, and tank components exposed to outdoor air. The applicant further proposed to manage external surface loss of material due to crevice and pitting corrosion of aluminum piping, piping components, piping elements, and tanks exposed to outdoor air using the External Surfaces Monitoring Program.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff noted that GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," recommends use of visual inspections of internal surfaces to manage the loss of material due to various corrosion mechanisms and fouling of steel components that are not covered by other AMPs. The staff finds that the credited AMP is appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

The staff noted that the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program has expanded its scope of aging effects to include SCC, which is beyond the scope of GALL AMP XI.M38. The staff required additional information to determine if the applicant's AMP provides adequate aging management for detecting tight stress corrosion cracks because such cracks are difficult to detect by visual inspection.

By letter dated December 1, 2009, the staff issued RAI B.2.23-1 requesting that the applicant provide additional information justifying the effectiveness of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program in managing SCC of the aluminum components. In its response dated December 30, 2009, the applicant stated that its AMP will use enhanced visual and/or volumetric inspection methods, as recommended in GALL AMP XI.M32, to detect stress corrosion cracks. The staff finds the applicant's response acceptable because use of enhanced visual and/or volumetric inspection methods for detecting the aging effect of SCC is consistent with the recommendation in GALL AMP XI.M32. The staff's concern described in RAI B.2.23-1 is resolved.

The staff reviewed the applicant's External Surfaces Monitoring Program, which is documented in SER Section 3.0.3.2.11. The staff determined that the credited AMP is appropriate because the External Surfaces Monitoring Program requires periodic inspections and monitoring of the component external surface to manage the aging effects of loss of material due to general, pitting, and crevice corrosion.

The staff's evaluation for carbon or low alloy steel emergency feedwater pump and emergency diesel generator starting air receivers, piping, piping components, piping elements, tanks, system strainers, and containment isolation piping exposed to indoor uncontrolled air which are being managed for loss of material due to general, crevice, and pitting corrosion and flow blockage due to fouling using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.26.

In LRA Table 3.3.2-50, the applicant stated that copper and copper alloy piping, piping components, piping elements, and tanks exposed to air – indoor uncontrolled (internal) does not have an aging effect, therefore, an AMP is not required. The AMR line items cite generic note J.

The staff noted that the environment of air–indoor uncontrolled is defined by the applicant the same definition as that in the GALL Report. The staff reviewed GALL Report Section V.F and noted that GALL AMR item V.F-3 states that piping, piping components, and piping elements fabricated of copper alloy that are exposed to air–indoor uncontrolled does not experience an AERM. Therefore, the staff determined the applicant has appropriately identified that the copper alloy piping, piping components, and piping elements do not experience an AERM because it is consistent with the recommendations of GALL AMR item V.F-3.

The staff's evaluation for fiberglass and fiber-reinforced plastic components exposed to uncontrolled indoor air and open-cycle cooling water or raw water which are being managed for hardening and loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.49.

The staff's evaluation for fiberglass or fiber-reinforced plastic components exposed to uncontrolled air or raw water which are being managed for loss of strength due to elastomer/plastic degradation by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled air, outdoor air, raw water, closed-cycle cooling water, and treated water which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for PVC and thermoplastic components exposed to uncontrolled indoor air and outdoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.11.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, galvanic, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.51 Secondary Services Closed-Cycle Cooling System-Summary of Aging Management Review–LRA Table 3.3.2-51

The staff reviewed LRA Table 3.3.2-51, which summarizes the results of AMR evaluations for the secondary services closed-cycle cooling system component groups.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.27.

The staff's evaluation for copper and copper alloy components exposed to raw water (internal or external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-51, the applicant proposed to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of aluminum motor cooler tubes exposed to an indoor uncontrolled air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds that the credited AMP is appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – outdoor (external) and air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.23.

In LRA Table 3.3.2-51, the applicant stated that the titanium heat exchanger components and tubes exposed to raw water (internal) are being managed for cracking due to SCC, flow blockage due to fouling, and reduction of heat transfer due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the associated items in the LRA and confirmed that the applicant has conservatively identified the correct aging effects for this component, material, and environment combination because titanium is susceptible to SCC in certain environmental conditions and flow blockage and reduction in heat transfer due to fouling are potential effects for raw water applications. In addition, the staff noted that in oxygenated environments like raw water, titanium is resistant to pitting, crevice, and general corrosion due to its formation of stable, continuous, highly adherent, and protective oxide films on its surfaces.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that GALL AMP XI.M38 recommends the use of visual inspections of internal surfaces to manage the loss of material due to various corrosion mechanisms and fouling of steel components that are not covered by other AMPs. The staff finds the applicant's proposed AMP acceptable for managing flow blockage due to fouling and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces because it requires periodic visual inspections of the component internal surfaces that are capable of detecting corrosion, corrosion byproducts, discoloration on the surface, scale/deposits, surface discontinuities that are indicative of flow blockage due to fouling, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces. However, the staff noted that the AMR line items indicate that the applicant's AMP has expanded its scope of aging effects to include cracking due to SCC, which is beyond the scope of GALL AMP XI.M38.

By letter dated December 1, 2009, the staff issued RAI B.2.23-1 requesting that the applicant justify the effectiveness of the applicant's program in managing cracking due to SCC of the titanium components.

In its response dated December 30, 2009, the applicant stated that its AMP will use enhanced visual and/or volumetric inspection methods, as recommended in GALL AMP XI.M32, "One-Time Inspection," to detect stress corrosion cracks. The staff finds the applicant's response and proposed AMP acceptable for managing cracking due to SCC because use of enhanced visual and/or volumetric inspection methods is capable of detecting stress corrosion cracks and is consistent with the recommendations in GALL AMP XI.M32. The staff's concern described in RAI B.2.23-1 is resolved. Based on the staff's review of the LRA and RAI B.2.23-1, the staff finds the applicant's proposed AMR acceptable.

In LRA Table 3.3.2-51, the applicant stated that the titanium heat exchanger components and tubes exposed to closed-cycle cooling water (external) are being managed for cracking due to SCC, loss of material due to crevice corrosion, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Closed-Cycle Cooling Water System Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has conservatively identified the correct aging effects for this component, material, and environment combination because titanium is susceptible to SCC in certain environmental conditions and, although not a significant concern, reduction in heat transfer due to fouling is a potential effect for closed-cycle cooling water environments. In addition, the staff noted that in a non-oxygen environment like closed-cycle cooling water, the oxide film will not reform if damaged making it susceptible to crevice corrosion.

The staff reviewed the applicant's Closed-Cycle Cooling Water System Program and its evaluation is documented in SER Section 3.0.3.2.4. The staff finds the applicant's proposed

AMP acceptable for managing cracking due to SCC, loss of material due to crevice corrosion, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces because it includes system corrosion inhibitors to minimize corrosion and surveillance testing and inspection to evaluate system and component performance. The staff noted that controlling closed cooling water chemistry creates an environment that is not conducive for loss of material and cracking. Furthermore, this program performs surveillance testing and inspections that will verify the effectiveness of the chemistry control and of system and component performance.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.52 Station Drains System-Summary of Aging Management Review–LRA Table 3.3.2-52

The staff reviewed LRA Table 3.3.2-52, which summarizes the results of AMR evaluations for the station drains system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument air receivers, and tank elements exposed to raw water which are being managed for flow blockage and reduction of heat transfer effectiveness due to fouling by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.34.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for gray cast iron piping, piping components, and piping elements exposed to raw water which are being managed for flow blockage due to fouling by the

Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, with generic note J, is documented in SER Section 3.3.2.3.34.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.53 Spent Fuel Cooling System-Summary of Aging Management Review–
LRA Table 3.3.2-53

The staff reviewed LRA Table 3.3.2-53, which summarizes the results of AMR evaluations for the spent fuel cooling system component groups.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

In LRA Table 3.3.2-53, the applicant stated that stainless steel spent fuel cooler tubes exposed to treated water are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Water Chemistry Program. The AMR line items cite generic note J. While this AMR item is not in the GALL Report, it is similar to GALL Report item VII.A3-8, which is for stainless steel heat piping, piping components, and piping elements exposed to treated borated water and which recommends use of the Water Chemistry Program.

The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The applicant stated that this program mitigates fouling by monitoring and maintaining water chemistry within industry guidelines. The staff finds the applicant's proposal to use the Water Chemistry Program acceptable because the program monitors the water for contaminants in order to minimize fouling and includes corrosion inhibitors.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.54 Nuclear Services Closed-Cycle Cooling System-Summary of Aging Management Review – LRA Table 3.3.2-54

The staff reviewed LRA Table 3.3.2-54, which summarizes the results of AMR evaluations for the nuclear services closed-cycle cooling system component groups.

The staff's evaluation for elastomer components exposed to uncontrolled air, closed-cycle cooling water, and raw water which are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air which are being managed for hardening and loss of strength by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for elastomer components exposed externally to uncontrolled indoor air which are being managed for loss of material due to wear by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.3.2.3.22.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.27.

The staff's evaluation for copper and copper alloy components exposed to raw water (internal or external) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.3.2.3.1.

In LRA Table 3.3.2-54, the applicant proposed to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of aluminum or aluminum-alloy motor cooler tubes exposed to an indoor uncontrolled air (extern) using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds that the credited AMP is appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.2.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR line item in LRA Table 3.3.2-54 for carbon or low alloy steel piping, piping elements, piping components, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.55 Waste Disposal System-Summary of Aging Management Review– LRA Table 3.3.2-55

The staff reviewed LRA Table 3.3.2-55, which summarizes the results of AMR evaluations for the waste disposal system component groups.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and system strainers exposed to indoor air which are being managed for loss of material or flow blockage by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.26.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.56 Radioactive Gas Waste Disposal System - Summary of Aging Management Review– LRA Table 3.3.2-56

The staff reviewed LRA Table 3.3.2-56, which summarizes the results of AMR evaluations for the radioactive gas waste disposal system component groups.

The staff's evaluation for stainless steel piping, piping components, piping elements, tanks, and system strainers exposed to indoor air which are being managed for loss of material or flow blockage by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.26.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR line item in LRA Table 3.3.2-56 for stainless steel piping, piping elements, piping components, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for stainless steel piping, piping components, piping elements, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air

Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.57 Radioactive Liquid Waste Disposal System-Summary of Aging Management Review–LRA Table 3.3.2-57

The staff reviewed LRA Table 3.3.2-57, which summarizes the results of AMR evaluations for the radioactive liquid waste disposal system component groups.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

The staff's evaluation for piping insulation exposed to outdoor air or uncontrolled indoor air with no aging effect, with generic note J, is documented in SER Section 3.3.2.3.20.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to raw water which are being managed for loss of material due to pitting, crevice, microbiologically-influenced, and galvanic corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.27.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.58 Reactor Coolant and Miscellaneous Waste Evaporator System - Summary of Aging Management Review – LRA Table 3.3.2-58

The staff reviewed LRA Table 3.3.2-58, which summarizes the results of AMR evaluations for the reactor coolant and miscellaneous waste evaporator system component groups.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR line item in LRA Table 3.3.2-58 for aluminum piping, piping elements, piping components, and tanks exposed to dry air with no AERMs and, therefore, no AMP. The AMR line items cite generic note J. The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR line item in LRA Table 3.3.2-58 for stainless steel piping, piping elements, piping components, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for stainless steel piping, piping components, piping elements, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.59 Waste Gas Sampling System - Summary of Aging Management Review – LRA Table 3.3.2-59

The staff reviewed LRA Table 3.3.2-59, which summarizes the results of AMR evaluations for the waste gas sampling system component groups.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, and system strainers exposed to indoor air which are being managed for loss of material due to crevice or pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.33.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR in LRA Table 3.3.2-59 for stainless steel piping, piping elements, and piping components exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for stainless steel piping, piping components, piping elements, and tanks exposed to raw water which are being managed for loss of material due to crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.60 Waste Sampling System-Summary of Aging Management Review–LRA Table 3.3.2-60

The staff reviewed LRA Table 3.3.2-60, which summarizes the results of AMR evaluations for the waste sampling system component groups.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, and system strainers exposed to indoor air which are being managed for loss of material due to crevice or pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.33.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.61 Post-Accident Containment Atmospheric Sampling System-Summary of Aging Management Review–LRA Table 3.3.2-61

The staff reviewed LRA Table 3.3.2-61, which summarizes the results of AMR evaluations for the post-accident containment atmospheric sampling system component groups.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, with generic note J, is documented in SER Section 3.3.2.3.1.

The staff's evaluation for stainless steel piping, piping components, piping elements, containment isolation piping, tanks, strainer screens and elements, reactor coolant drain tank, and sample cooler components exposed to raw water which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and cracking due to SCC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.3.2.3.20.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion systems components and component groups of the following:

- condenser air removal system
- auxiliary steam system
- condensate system
- once-through steam generator chemical cleaning system
- condensate and feedwater chemical cleaning system
- condensate demineralizer system
- emergency feedwater system
- main feedwater system
- gland steam system
- gland seal water system

- main feedwater turbine lube oil system
- main steam system
- relief valve vent system
- secondary plant system

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion system components and component groups. LRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion Systems Evaluated in Chapter VIII of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's review are documented in SER Section 3.4.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.4.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.4.2.3.

For SSCs which the applicant claimed are not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.4-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.4 and addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion Systems Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.4.2.2.1)
Steel piping, piping components, and piping elements exposed to steam (3.4.1-2)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.2(1))
Steel heat exchanger components exposed to treated water (3.4.1-3)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.2.2(1))
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-4)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.2(1))
Steel heat exchanger components exposed to treated water (3.4.1-5)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.4.2.2.2(9))
Steel and stainless steel tanks exposed to treated water (3.4.1-6)	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.7(1))
Steel piping, piping components, and piping elements exposed to lubricating oil (3.4.1-7)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.2(2))

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling	Plant-specific	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.2.3)
Stainless steel and copper alloy heat exchanger tubes exposed to treated water (3.4.1-9)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.4(1))
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.4.1-10)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.4(2))
Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil (3.4.1-11)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes	Buried Piping and Tanks Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.5(1))
Steel heat exchanger components exposed to lubricating oil (3.4.1-12)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.2.5(2))
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-13)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.4.2.2.6)
Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water > 60 °C (140 °F) (3.4.1-14)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.6)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water (3.4.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.7(1))
Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.7(1))
Stainless steel piping, piping components, and piping elements exposed to soil (3.4.1-17)	Loss of material due to pitting and crevice corrosion	Plant-specific	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.2.7(2))
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-18)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.7(3))
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil (3.4.1-19)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis Program and One-Time Inspection Program	Consistent with GALL Report (See SER Section 3.4.2.2.8)
Steel tanks exposed to air – outdoor (external) (3.4.1-20)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Aboveground Steel Tanks Program	Consistent with GALL Report
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-21)	Cracking due to cyclic loading and SCC	Bolting Integrity	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel bolting and closure bolting exposed to air with steam or water leakage, air – outdoor (external), or air – indoor uncontrolled (external) (3.4.1-22)	Loss of material due to general, pitting, and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 60 °C (140 °F) (3.4.1-23)	Cracking due to SCC	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Steel heat exchanger components exposed to closed-cycle cooling water (3.4.1-24)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.4.1-25)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water (3.4.1-26)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water (3.4.1-27)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel external surfaces exposed to air – indoor uncontrolled (external), condensation (external), or air – outdoor (external) (3.4.1-28)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surfaces Monitoring Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-29)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Flow-Accelerated Corrosion Program	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air – outdoor (internal) or condensation (internal) (3.4.1-30)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with GALL Report
Steel heat exchanger components exposed to raw water (3.4.1-31)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.4.1-32)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.4.1-33)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water (3.4.1-34)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed-cycle cooling water, raw water, or treated water (3.4.1-35)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials Program	Consistent with GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water (3.4.1-36)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials Program	Consistent with GALL Report
Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam (3.4.1-37)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report
Steel bolting and external surfaces exposed to air with borated water leakage (3.4.1-38)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to SCC	Water Chemistry	No	Water Chemistry Program	Consistent with GALL Report
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	NA	NA	Consistent with GALL Report
Stainless steel, copper alloy, and nickel-alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external) (3.4.1-41)	None	None	NA	NA	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to air – indoor controlled (external) (3.4.1-42)	None	None	NA	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	NA	Not applicable	Not applicable to CR-3 (See SER Section 3.4.2.1.1)
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	NA	NA	Consistent with GALL Report

The staff's review of the steam and power conversion system component groups followed any one of several approaches. One approach, documented in SER Section 3.4.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.4.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the steam and power conversion system components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- Aboveground Steel Tanks Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Buried Piping and Tanks Inspection Program
- Closed-Cycle Cooling Water Program

- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

LRA Tables 3.4.2-1 through 3.4.2-15 summarize AMRs for the steam and power conversion system components and indicate AMRs claimed to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMR's that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the steam and power conversion systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.4.1, the applicant's references to the GALL Report are acceptable, and no further staff review is required.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

3.4.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.4.1, item 3.4.1-21 addresses high-strength steel closure bolting exposed to air with steam or water leakage in the steam and power conversion systems. The applicant stated that this item is not applicable because there is no high-strength closure bolting in the steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff reviewed the applicant's FSAR and confirmed that no in-scope, high-strength steel closure bolting exposed to air with steam or water leakage is present in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4.1, item 3.4.1-26 addresses loss of material due to pitting, crevice, and galvanic corrosion in copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The applicant stated that this line item is not applicable to its steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water are present in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4.1, item 3.4.1-31 addresses loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion and fouling in steel heat exchanger components exposed to raw water. The applicant stated that this line item is not applicable to the steam and power conversion systems at CR-3. The staff reviewed LRA Sections 2.3.4 and 3.4 and, contrary to the applicant's statement, identified steel motor cooler components, which the staff considers heat exchanger components, for the motor-driven emergency feedwater pump that is exposed to raw water. For these components, the applicant proposed to manage the aging effects of loss of material due to various corrosion mechanisms using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and its evaluation is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposal to manage aging using the referenced program acceptable because it performs periodic visual inspections of internal surfaces of components during opportunities created from existing work order tasks. The staff noted that visual inspections are capable of identifying corrosion, corrosion byproducts, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material.

LRA Table 3.4.1, item 3.4.1-32 addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion in stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water. The applicant stated that this item is not applicable to the steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and noted in LRA Tables 3.4.2-1 and 3.4.2-7 that the applicant has AMR line items for stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water in which it cited generic note J. The staff also noted that the applicant proposed to manage aging of stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff's evaluation of this proposal is documented in SER Sections 3.4.2.3.1 and 3.4.2.3.7.

LRA Table 3.4.1, item 3.4.1-33 addresses loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling in stainless steel heat exchanger components exposed to raw water. The applicant stated that this item is not applicable to the steam and power conversion systems. The staff reviewed LRA Sections 2.3.4 and 3.4 and noted in LRA Table 3.4.2-1 that the applicant has an AMR line item for stainless steel heat exchanger components exposed to raw water in which it cited generic note J. The staff also noted that the applicant proposed to manage aging of stainless steel heat exchanger components exposed to raw water with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting

Components Program. The staff's evaluation of this proposal is documented in SER Section 3.4.2.3.1.

LRA Table 3.4.1, item 3.4.1-34 addresses reduction of heat transfer due to fouling in steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water. The applicant stated that this line item is not applicable to its steam and power conversion. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water. The staff also reviewed the applicant's FSAR and confirmed that no in-scope steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water are present in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4.1, item 3.4.1-42 addresses steel piping, piping components, and piping elements exposed to indoor controlled air and states that the item is not applicable to CR-3. LRA Table 3.4.1, item 3.4.1-42, correspond to GALL Report Table 4, item 42 which references GALL Report, Table VIII.I, item VIII.I-13 which recommends no aging effect/mechanism and no AMP for this component group exposed to this environment. The staff finds the applicant's determination of not applicable equivalent to the GALL Report recommendations and, therefore, acceptable.

LRA Table 3.4.1, item 3.4.1-43 addresses steel and stainless steel piping, piping components, and piping elements exposed to concrete and states that the item is not applicable to CR-3. LRA Table 3.4.1, item 3.4.1-43, correspond to GALL Report Table 4, item 43 which references GALL Report, Table VIII.I, items VIII.I-11 and VIII.I-14 which recommend no aging effect/mechanism and no AMP for this component group exposed to this environment. The staff finds the applicant's determination of not applicable equivalent to the GALL Report recommendations and, therefore, acceptable.

3.4.2.1.2 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.4.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.4.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the steam and power conversion system components and provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice, and galvanic corrosion
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2. The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.4.2.2.1, the applicant stated that fatigue evaluation is a TLAA as defined in 10 CFR 54.3 and that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The applicant stated that the evaluation of this TLAA is separately addressed in LRA Section 4.3.

The staff noted that it was unclear whether LRA Section 4.3 included a fatigue TLAA for the following components from the applicant's AMR line items: EFP-3 diesel engine exhaust expansion joints and silencers, standpipes, hydrants and tanks, deaerator, expansion joints, feedwater booster pumps, feedwater heaters, and main feedwater pumps.

The staff reviewed LRA Section 4.3 but was not able to locate the discussion for these AMR line items. By letter dated September 11, 2009, the staff issued RAI 3.3.2.2.1-1 requesting that the applicant identify the subsections of LRA Section 4.3 that discuss these components and provide the methods used for the TLAA analysis for these components.

The staff's review of RAI 3.3.2.2.1-1 and its evaluation and acceptance of the applicant's response are documented in SER Section 3.3.2.2.1.

The staff verified that in LRA Section 4.3.2.2, the applicant provided its fatigue TLAA evaluation for components included in this section. The staff's evaluation of this TLAA, USAS B31.1.0 Piping - Non-Class 1 components, is documented in SER Section 4.3.2.2.2.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.

(1) LRA Table 3.4.1, items 3.4.1-02 and 3.4.1-04 refer to LRA Section 3.4.2.2.2.1 and address steel heat exchanger components exposed to treated water and steel piping, piping components, and piping elements exposed to treated water or steam which are being managed for loss of material due to general, pitting, and crevice corrosion. The applicant addressed the further evaluation criteria of the SRP-LR by stating that steel piping, piping components, piping elements, and tanks exposed to treated water or steam will be managed for loss of material due to general, pitting, and crevice corrosion by the Water Chemistry Program augmented by the One-Time Inspection Program.

The staff reviewed LRA Section 3.4.2.2.2.1 against the criteria described in SRP-LR Section 3.4.2.2.2, item 1, which states that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The SRP-LR also states that the existing AMP relies on the Water Chemistry Program but that this should be augmented with a one-time inspection of selected components at susceptible locations to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff noted that these programs provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits defined by the EPRI Water Chemistry Guidelines and will perform one-time inspections of components to detect material loss. In its review of components associated with items 3.4.1-02 and 3.4.1-04, the staff finds the applicant's management of loss of material due to general, pitting, and crevice corrosion acceptable because it is consistent with the acceptance criteria in SRP-LR Section 3.4.2.2.2, item 1.

LRA Table 3.4.1, item 3.4.1-03 refers to LRA Section 3.4.2.2.2.1, which addresses loss of material due to general, pitting, and crevice corrosion in steel heat exchanger components exposed to treated water. The applicant stated that this line item is not applicable because the steam generator blowdown components in the steam and power conversion system do not contain in-scope heat exchanger components with this material-environment combination. The staff reviewed LRA Sections 2.3.4 and 3.4 and FSAR Section 10.2.1.4 and confirmed that no in-scope steel heat exchanger components exposed to treated water are present in the steam and power conversion system and, therefore, finds the applicant's determination acceptable.

(2) LRA Table 3.4.1, item 3.4.1-07 refers to LRA Section 3.4.2.2.2.2 and addresses steel piping, piping components, and piping elements exposed to lubricating oil in steam and

power conversion systems which are being managed for loss of material due to general, pitting, and crevice corrosion by the combination of the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program augmented by the One-Time Inspection Program to verify program effectiveness. The applicant also stated that the Lubricating Oil Analysis Program monitors the level of contaminants to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer, and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring, or if it is, it triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.4.2.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2, item 2, which states that loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of the lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA item 3.4.1-07, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control for loss of material due to pitting and crevice corrosion by periodic sampling of lubricating oil to maintain contaminants at acceptable limits and through a one-time inspection of selected steel piping, piping components, and piping elements exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2 criteria. For those line items that apply to LRA Section 3.4.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Section 3.4.2.2.3 addresses steel piping, piping components, and piping elements exposed to raw water which are being managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling. The applicant addressed the further evaluation criteria of the SRP-LR by stating that this item is not applicable because the emergency feedwater system and portions of the feedwater system that provide the auxiliary feedwater function are not exposed to raw water.

SRP-LR Table 3.4-1, item 8 refers to SRP-LR Section 3.4.2.2.3. The staff reviewed LRA Section 3.4.2.2.3 against the criteria described in SRP-LR Section 3.4.2.2.3, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The SRP-LR also states that a plant-specific AMP should be evaluated to manage these aging effects.

In its review of the LRA, the staff noted that in LRA Table 3.4.2-1, the component group "piping, piping components, piping elements, and tanks" is identified as carbon or low alloy steel in an environment of raw water. By letter dated December 1, 2009, the staff issued RAI 3.4.2.2.3-1 requesting that the applicant provide additional information on why LRA Section 3.4.2.2.3 indicates that there is no steel piping exposed to raw water, whereas LRA Table 3.4.2-1 indicates the opposite. In its response dated December 30, 2009, the applicant indicated that LRA Table 3.4.2-1 identifies the condenser air removal system piping, piping components, piping elements, and tanks. The applicant further indicated that this piping is exposed to a saturated air internal environment but was evaluated as exposed to raw water for the purposes of generating a bounding set of aging effects. The staff reviewed the applicant's FSAR and confirmed that there are no in-scope steel piping, piping elements, and piping components exposed to raw water in the feedwater or emergency feedwater systems. Based on the applicant's response to RAI 3.4.2.2.3-1 and review of the LRA and FSAR, the staff finds the applicant's determination that this line item is not applicable acceptable.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4.

(1) LRA Table 3.4.1, item 3.4.1-09 refers to LRA Section 3.4.2.2.4.1 and addresses stainless steel and copper alloy heat exchanger tubes exposed to treated water which are being managed for reduction of heat transfer due to fouling by the Water Chemistry and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Water Chemistry Program monitors and controls water chemistry to prevent or mitigate fouling, and that the One-Time Inspection Program verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.4.2.2.4.1 against the criteria in SRP-LR Section 3.4.2.2.4, item 1, which states that reduction of heat transfer due to fouling may occur in stainless steel and copper alloy heat exchanger tubes exposed to treated water and that management of this aging effect relies on water chemistry control. The SRP-LR also states that since control of water chemistry may have been inadequate, the GALL Report recommends that the effectiveness of the chemistry control program be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is noted as an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff's evaluations of the applicant's Water Chemistry and One-Time Inspection programs are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.4.1, item 3.4.1-09, the staff finds the applicant's proposal to manage aging using the Water Chemistry and One-Time Inspection programs acceptable because the Water Chemistry Program monitors and controls water chemistry to keep contaminant levels below specified limits to minimize fouling and the effectiveness of the Water Chemistry Program is verified through the One-Time Inspection Program, which will confirm the absence of reduction in heat transfer.

(2) LRA Table 3.4.1, item 3.4.1-10 refers to LRA Section 3.4.2.2.4.2 and addresses steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil which are being managed for reduction of heat transfer due to fouling by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Lubricating Oil Analysis Program maintains contaminants within limits to preserve an environment that is not conducive to reduction of heat transfer and the One-Time Inspection Program verifies that unacceptable degradation of the applicable components is not occurring.

The staff reviewed LRA Section 3.4.2.2.4.2 against the criteria in SRP-LR Section 3.4.2.2.4, item 2, which states that loss of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on monitoring and control of lubricating oil chemistry to mitigate reduction of heat transfer due to fouling; however, control of lubricating oil contaminants may not always be fully effective in precluding corrosion. The SRP-LR notes that the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil programs and notes that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that this aging effect is not occurring.

The staff's evaluation of the applicant's Lubricating Oil Analysis and One-Time Inspection programs is documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with item 3.4.1-10, the staff finds the applicant's proposal to manage aging using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because the Lubricating Oil Analysis Program will monitor and control lubricating oil chemistry to mitigate the reduction of heat transfer by fouling, and the One-Time Inspection Program will use appropriate NDE methods including visual, ultrasonic, and surface examinations to detect aging effects.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4 criteria. For those line items that apply to LRA Section 3.4.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.5 against the criteria in SRP-LR Section 3.4.2.2.5:

(1) LRA Table 3.4.1, item 3.4.1-11 refers to LRA Section 3.4.2.2.5.1 and addresses steel piping, piping components, piping elements, and tanks exposed to soil in buried portions of the condensate system which are being managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion by the Buried Piping and

Tanks Inspection Program. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion.

The staff reviewed LRA Section 3.4.2.2.5.1 against the criteria in SRP-LR Section 3.4.2.2.5, item 1, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur in steel (with or without coating or wrapping) piping, piping components, piping elements, and tanks exposed to soil. The SRP-LR also states that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion. The SRP-LR also states that the effectiveness of the program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program, and its evaluation is documented in SER Section 3.0.3.1.10. In its review of components associated with item 3.4.1-11, the staff finds the applicant's proposal to manage aging using the Buried Piping and Tanks Inspection Program acceptable because it uses appropriate preventive measures and inspections to detect the aging effect.

(2) LRA Table 3.4.1, item 3.4.1-12 refers to LRA Section 3.4.2.2.5.2 and addresses steel heat exchanger components exposed to lubricating oil. The applicant stated that this line item is not applicable because the emergency feedwater system heat exchanger components and feedwater system components performing the auxiliary feedwater function exposed to lubricating oil are not constructed of steel. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the emergency feedwater or feedwater systems that include steel heat exchanger components and elements exposed to lubricating oil. The staff reviewed the applicant's FSAR and LRA and confirmed that there are no in-scope steel heat exchangers or lube oil cooler components exposed to lubricating oil present in the emergency or main feedwater systems or auxiliary systems and, therefore, the staff finds the applicant's determination acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.5 criteria. For those line items that apply to LRA Section 3.4.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.6 Cracking Due to Stress-Corrosion Cracking

LRA Table 3.4.1, item 3.4.1-14 refers to LRA Section 3.4.2.2.6 and addresses stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to steam or treated water with a temperature greater than 140 °F which are being managed for cracking due to SCC by the Water Chemistry Program and the One-Time Inspection Program. The applicant addressed the further evaluation requirements by stating that the Water Chemistry Program provides for monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the cracking and loss of material aging effects and the One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The applicant stated that LRA Table 3.4.1, item 3.4.1-13 is not applicable because it relates to BWR systems. The staff confirmed that the guidance in SRP-LR Table 3.4-1, item 13 is applicable only to BWRs and is not applicable to CR-3, which is a PWR.

The staff reviewed LRA Section 3.4.2.2.6 against the criteria described in SRP–LR Section 3.4.2.2.6, which states that SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 140 °F and for stainless steel piping, piping components, and piping elements exposed to steam. The SRP-LR also states that the existing water chemistry program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program, and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. In its review of components associated with LRA Table 3.4.1, item 3.3.1-14, the staff finds the applicant's proposal to manage aging using the Water Chemistry Program and the One-Time Inspection Program acceptable because the applicant is managing these components consistent with the recommendations in GALL Report AMR items VIII.B1-5, VIII.D1-5, VIII.E-30, and VIII.G-33; the applicant's Water Chemistry Program controls peak levels of various contaminants (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) below the system-specific limits that can accelerate corrosion and cracking, and the applicant's One-Time Inspection Program performs appropriate NDE examinations capable of detecting cracking due to SCC and cyclic loading to either verify that unacceptable degradation is not occurring or prompts actions that assure the intended function of the components will be maintained.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those line items that apply to LRA Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.7 against the criteria in SRP-LR Section 3.4.2.2.7.

(1) LRA Table 3.4.1, items 3.4.1-15 and 3.4.1-16 refer to LRA Section 3.4.2.2.7.1 and address aluminum and copper alloy piping, piping components, and piping elements and stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water which are being managed for loss of material due

to pitting and crevice corrosion by the Water Chemistry and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that it will manage aging for these components using the Water Chemistry Program, which provides for monitoring and controlling water chemistry, and the One-Time Inspection Program, which provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions.

The staff reviewed LRA Section 3.4.2.2.7.1 against the criteria described in SRP-LR Section 3.4.2.2.7, item 1, which states that the loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components, and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The SRP-LR also states that the existing AMP relies on the Water Chemistry Program but that this should be augmented with a one-time inspection of selected components at susceptible locations to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The staff reviewed the Water Chemistry and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff noted that these programs provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits defined by the EPRI Water Chemistry Guidelines and will perform one-time inspections of components to confirm the effectiveness of the Water Chemistry Program. The staff finds the applicant’s management of loss of material due to pitting and crevice corrosion for these components acceptable because the applicant’s proposed programs are consistent with the acceptance criteria in SRP-LR Section 3.4.2.2.7, item 1.

(2) LRA Table 3.4.1, item 3.4.1-17 refers to LRA Section 3.4.2.2.7.2 and addresses stainless steel piping exposed to soil affected by loss of material due to pitting and crevice corrosion. The applicant stated that this line item is not applicable because the condensate systems, emergency feedwater system, and portions of the feedwater system associated with the auxiliary feedwater function do not contain stainless steel components exposed to soil. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that the applicant’s LRA does not have any AMR results for the steam and power conversion systems that include stainless steel piping exposed to soil. The staff reviewed the applicant’s FSAR and confirmed that no in-scope stainless steel piping exposed to soil is present in the steam and power conversion systems and, therefore, finds the applicant’s determination acceptable.

(3) LRA Table 3.4.1, item 3.4.1-18 refers to LRA Section 3.4.2.2.7.3 and addresses copper alloy piping, piping components, and piping elements exposed to lubricating oil which are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program to be within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking, or reduction of heat transfer. The applicant also stated the One-Time Inspection Program verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.4.2.2.7.3 against the criteria in SRP-LR Section 3.4.2.2.7, item 3, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of the lubricating oil to maintain contaminants within acceptable limits, thus preserving the environment against corrosion. The SRP-LR further states that the effectiveness of the Lubricating Oil Analysis Program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs, and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. In its review of components associated with LRA item 3.4.1-18, the staff finds the applicant's proposal to manage aging effects using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because they provide measures to control loss of material due to pitting and crevice corrosion through periodic sampling of lubricating oil to maintain contaminants at acceptable limits and one-time inspections of select copper alloy piping, piping components, and piping elements exposed to lubricating oil to verify the effectiveness of the Lubricating Oil Analysis Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7 criteria. For those line items that apply to LRA Section 3.4.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.4.1, item 3.4.1-19 refers to LRA Section 3.4.2.2.8 and addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Lubricating Oil Analysis and One-Time Inspection programs. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the level of contaminants (primarily water and particulates) within the oil systems are controlled by the Lubricating Oil Analysis Program to be within acceptable limits, thereby preserving the environment against loss of material, cracking, or reduction of heat transfer. The applicant also stated that the One-Time Inspection Program verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. However, the applicant also stated that its methodology does not predict MIC in lubricating oil systems unless indicated by operating experience.

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The SRP-LR also states that the existing AMP relies on the periodic sampling and analysis of lubricating oil to assure contaminants remain within acceptable limits and thus support an environment unfavorable to corrosion. The SRP-LR further states that control of lubricating oil contaminants may not always have been adequate to preclude the occurrence of corrosion and, therefore, the effectiveness of the Lubricating Oil Program to manage corrosion should be verified and that a one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In its review of components associated with LRA item 3.4.1-19, the staff noted that while SRP-LR Section 3.4.2.2.8 advocates active control of MIC, the applicant differs in its assessment, stating that MIC will not be addressed unless operating experience indicates otherwise. Because early detection of MIC is crucial to prevent failures, the staff issued RAI 3.4.2.2.8-1 by letter dated December 1, 2009, requesting that the applicant provide additional information regarding how it identifies and mitigates the effects of MIC. In its response dated December 30, 2009, the applicant stated that its Lubricating Oil Analysis Program routinely monitors for the presence of water and particulates in oil, which is consistent with the GALL Report, because water and particulates not only impact the quality of lubricating oil but also are precursors to other potential problems, including MIC. The applicant also stated that if the presence of water or contaminants is established, then further investigation ensues to determine the cause of the contamination. The applicant further stated that although there is no predetermined course of action associated with lubricating oil analysis results exceeding certain limits, additional tests are done, such as bacteria counts, to determine any corrective or mitigating actions required. The staff finds the applicant's response acceptable because the applicant regularly monitors the quality of the lubricating oil and any unacceptable conditions are resolved through the applicant's corrective action program, which includes ongoing monitoring, trending, and further testing, as appropriate. The staff's concern described in RAI 3.4.2.2.8-1 is resolved.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. The staff finds the applicant's proposal to use the Lubricating Oil Analysis and One-Time Inspection programs to manage aging for these components acceptable because both of these programs are consistent with the GALL Report recommendations, and unacceptable findings are evaluated in accordance with the site corrective action process to determine the need for subsequent inspections and for monitoring and trending the results.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.8 criteria. For those line items that apply to LRA Section 3.4.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

LRA Section 3.4.2.2.9 addresses condensate system heat exchanger components exposed to treated water, stating that the aging effect is applicable to BWRs only. SRP-LR Section 3.4.2.2.9 states that loss of material due to general, pitting, crevice, and galvanic corrosion may occur in steel heat exchanger components exposed to treated water. SRP-LR Table 3.4-1, item 5 references SRP-LR Subsection 3.4.2.2.9 and states that the item is applicable to BWRs only. The staff finds that SRP-LR Section 3.4.2.2.9 is not applicable to

CR-3 because CR-3 is a PWR, and the staff guidance in this SRP-LR section is only applicable to BWRs.

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-15, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-15, via notes F through J, the applicant indicated which combinations of component type, material, environment, and AERM do not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.4.2.3.1 Condenser Air Removal System-Summary of Aging Management Review–
LRA Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condenser air removal system component groups.

In LRA Table 3.4.2-1, the applicant stated that stainless steel condenser vacuum pump heat exchangers, piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed all the AMR result lines in the GALL Report where the component and material is stainless steel piping, piping components, piping elements, tanks, and heat exchangers exposed to raw water and noted that the GALL Report recommends GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage the effects of loss of material for this component, material, and environment combination in the steam and power conversion systems section. Therefore, by letter dated December 1, 2009, the staff issued RAI 3.4.2.1-1 requesting that the applicant provide additional information on how the proposed AMP would adequately manage the effects of aging.

By letter dated December 30, 2009, the applicant responded to RAI 3.4.2.1-1 and stated that nonsafety-related components and heat loads are not included in the Open-Cycle Cooling Water System Program unless they are considered to directly support the intended function of safety-related components in the program.

The staff noted that since the components described in this case are not exposed to open-cycle cooling water (i.e., water that transfers heat from safety-related components to the ultimate heat sink), use of the Open-Cycle Cooling Water System Program would not be appropriate. Therefore, the staff's concern described in RAI 3.4.2.1-1 is resolved.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the applicant's proposed AMP acceptable to manage the aging effects of loss of material and reduction of heat transfer effectiveness because it performs periodic visual inspections of the internal surfaces of stainless steel piping, piping components, piping elements, tanks, and heat exchangers that are capable of detecting loss of material and reduction of heat transfer effectiveness.

In LRA Tables 3.4.2-1 and 3.4.2-2, the applicant stated that for aluminum piping, piping components, piping elements, and tanks exposed to a dried air environment, there is no AERM and, therefore, no AMP was assigned for these component, material, and environment combinations. The applicant cited generic note J.

The staff noted that the GALL Report recommends no AERM for aluminum piping, piping components, and piping elements in a controlled indoor air environment as indicated by GALL Report item VII.J–1 and in a gas environment as indicated by GALL Report item VII.J–2. The staff verified that the LRA definition of these environments is consistent with the GALL Report and, therefore, the staff finds these AMR line items acceptable.

In LRA Table 3.4.2-1, the applicant stated that carbon or low-alloy steel piping, piping components, piping elements, and tanks exposed to raw water are being managed for loss of material due to MIC using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds the proposed AMP acceptable to manage aging for these components because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires periodic inspections of component internal surfaces which are capable of detecting loss of material due to various corrosion mechanisms.

In LRA Table 3.4.2-1, the applicant stated that the copper and copper alloy piping, piping components, piping elements, and tanks exposed to raw water (internal) are being managed for cracking due to SCC and loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. In LRA Table 3.4.2-7, the applicant stated that the copper and copper alloy motor-driven emergency feedwater pump motor cooler components exposed to raw water (external) are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that this program will perform periodic visual inspections of internal surfaces of components during opportunities created from existing preventive maintenance, surveillance testing, and periodic testing work order tasks. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. The staff also determined that this program contains inspection techniques such as enhanced visual (VT-1 or equivalent) and/or volumetric (RT or UT) which is capable of detecting cracking due to SCC and is an acceptable means to detect cracking due to SCC, as recommended by the GALL Report. On the basis of its review, the staff finds that because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material and cracking, this program will adequately manage these aging effects when these components are exposed to raw water (external and internal).

The staff's evaluation for gray cast iron piping, piping components, piping elements, and tanks exposed to raw water which are being managed for loss of material due to MIC by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, with generic note J, is documented in SER Section 3.3.2.3.41.

LRA Tables 3.4.2-1 and 3.4.2-3 contain items which address hardening and loss of strength due to elastomer/plastic degradation of PVC, thermoplastics, and fiberglass or fiber-reinforced plastic piping, piping components, piping elements, and tanks exposed to treated water or raw water on the interior and outdoor air on the exterior. The applicant cited generic note J. The applicant acknowledged that aging may occur for this combination of materials and environments and proposed to manage it through the use of its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and External Surfaces Monitoring Program. The staff noted that GALL Report Sections IX.E and IX.F jointly state that the appropriate aging effect for elastomeric materials is hardening and loss of strength.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs is documented in SER Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. The staff questioned the applicant on the inclusion of physical manipulation of elastomeric materials in RAI B.2.23.2-1.1. The staff's evaluation of RAI B.2.23.2-1.1 is documented in SER Section 3.3.2.3.22.

The staff noted that the external surfaces monitoring program contained in the GALL Report is a visual inspection program and that hardening and loss of strength are not directly detected by visual examinations. Therefore, by letter dated December 1, 2009, the staff issued RAI 3.4.2.3-1 requesting that the applicant justify how the External Surfaces Monitoring Program will detect changes in hardness and strength of the plastic components under consideration or propose an AMP which will directly measure these changes.

By letter dated December 30, 2009, the applicant responded to RAI 3.4.2.3-1 by stating that the External Surfaces Monitoring Program has been credited with performing visual inspections for attributes that could be detected with visual methods (e.g., cracking, crazing, chalking, discoloration, fretting, delamination). In conjunction with the External Surfaces Monitoring Program, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program augments visual inspections with tests and inspections suitable for detecting the aging effects of interest. The staff finds the applicant's response acceptable because the combination of the External Surfaces Monitoring Program and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be able to detect and manage the aging effects of concern. The staff's concern described in RAI 3.4.2.3-1 is resolved.

The staff finds the applicant's proposal to manage aging using both the External Surfaces Monitoring and Internal Surfaces in Miscellaneous Piping and Ducting Components programs acceptable because between the two programs, appropriate visual, physical manipulation, or testing methods will be used to detect the aging effects.

By letter dated November 12, 2010, the applicant amended the LRA to include in LRA Tables 3.4.2-1, 3.4.2-2, 3.4.2-3, 3.4.2-6, 3.4.2-7, 3.4.2-8, 3.4.2-9, 3.4.2-10, and 3.4.2-12, AMRs for steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to dried air (inside) which are being managed for the loss of material by the Compressed Air Monitoring Program. The AMR items cite generic note J. The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because the applicant has recognized the possibility of moisture and/or condensation in systems which typically only contain dried air.

The staff's evaluation of the applicant's Compressed Air Monitoring Program is documented in SER Section 3.0.3.1.11. The staff noted that the applicant's Compressed Air Monitoring Program is identified as consistent with no enhancements or exceptions with the GALL Report Compressed Air Monitoring Program. The staff finds the applicant's proposal to manage aging using the Compressed Air Monitoring Program acceptable because steel, stainless steel, copper and copper alloy piping, piping components and piping elements in a dried air environment (with the potential for condensation) would have the same aging effect as the steel compressed air system piping, piping components and piping elements exposed to condensation described in item A-26 in the GALL Report, which recognizes loss of material as an aging effect to be managed by the Compressed Air Monitoring Program. On the basis that the LRA components are similar to other GALL Report items for the material and environment, the staff concurs that the effect of dried air (with the potential for condensation) may result in a potential loss of material can be effectively managed by the Compressed Air Monitoring Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Auxiliary Steam System-Summary of Aging Management Review-LRA Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the auxiliary steam system component groups.

LRA Tables 3.4.2-2, 3.4.2-7, 3.4.2-8, and 3.4.2-12 contain AMRs addressing piping insulation exposed to uncontrolled indoor and outdoor air. The AMR items cite generic note J. The applicant further proposed that this combination of environment and material is not subject to aging and that no AMP is required.

In its review of these items, the staff noted that, depending on the application, piping insulation may be fabricated from many materials. These materials commonly include polymeric foams, inorganic fibers, and solid ceramics. The staff also noted that the applicant did not state the type of insulation which was being used, the material of the pipe over which it was being applied, or the range of temperatures expected at the interface between the pipe and the insulation. The staff further noted that some types of insulation (e.g., polymeric foams) are subject to aging and may require aging management. Finally, the staff noted that the combined use of some forms of insulation and piping materials in some environments (e.g., chloride containing insulation over stainless steel pipe in humid environments) may create additional aging effects in the piping material.

By letter dated December 1, 2009, the staff issued RAI 3.2.2.3-1 requesting that the applicant provide sufficient information concerning the type of insulation being used, the type of pipe over which it will be applied, the compatibility between the insulation and the pipe, and whether the presence of condensation or other moisture is possible, to allow the staff to conclude whether the insulation is subject to aging or whether the use of the insulation will result in unexpected aging of the pipe material.

In its response dated December 30, 2009, the applicant stated that insulation materials used at the station include mineral fiber, calcium silicate, fiberglass, elastomeric foam, glass wool, and stainless steel reflective jacketing and based upon an operating experience review, for an indoor air uncontrolled environment, there are no AERMs. The applicant also stated that prevention of condensation is addressed by insulation specifications including installing an appropriate thickness of the material and insulating pipe supports on piping systems where the system temperature is below ambient air temperatures. The applicant further stated that each batch of insulation installed in the reactor building was tested for chlorides, sodium, and silicate.

Based on its review, the staff finds the applicant’s response acceptable because all of the insulation materials are not susceptible to aging with the exception of elastomeric foam, but given its jacketing it will not be exposed to high levels of ultraviolet light and, therefore, will not experience any appreciable aging. Further, the specifications controlled insulation installation to minimize the potential of condensation being formed between the insulation and pipe material; and testing was conducted on insulation material to ensure that leachable elements would not impact the piping.

The staff’s evaluation for aluminum, piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

In LRA Tables 3.4.2-2, 3.4.2-9, and 3.4.2-12, the applicant stated that carbon or low-alloy steel piping, piping components, piping elements, tanks, containment isolation piping, expansion joints, and system strainer screens and elements exposed to steam are being managed for loss of material due to general corrosion by the Water Chemistry Program. The AMR line items cite generic notes H and J.

The staff reviewed all AMR result lines in the GALL Report where the component and material is carbon or low-alloy steel piping, piping components, piping elements, tanks, containment isolation piping, expansion joints, and system strainer screens and elements exposed to steam and noted that GALL Report item VIII.B1-8 is similar with this component, material, environment, and aging effect combination. GALL Report item VIII.B1-8 recommends the use of the Water Chemistry Program to manage loss of material due to general corrosion. The staff reviewed the applicant's Water Chemistry Program and its evaluation is documented in SER Section 3.0.3.1.2. The applicant stated that this program will provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits defined by the EPRI Water Chemistry Guidelines. The staff finds the applicant's use of the Water Chemistry Program acceptable because it is consistent with GALL Report item VIII.B1-8.

In LRA Tables 3.4.2-2 and 3.4.2-7, the applicant stated that the copper and copper alloy piping, piping components, piping elements, tanks, and motor-driven emergency feedwater pump motor cooler components exposed to air-indoor uncontrolled (internal and external) are being managed for loss of material due to pitting and crevice corrosion and copper and copper alloy motor-driven emergency feedwater pump motor cooler tubes exposed to air-indoor uncontrolled (external) are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that this program will perform periodic visual inspections of external surfaces of components during periodic work order tasks, even though its title would imply that it only pertains to internal surfaces. The staff noted that a visual inspection will be capable of monitoring parameters such as corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. The staff also determined that the extent and schedule of inspections and testing assures detection of degradation prior to loss of intended function so that the determination of appropriate corrective actions will occur. In addition, the staff noted that since heat transfer reduction due to fouling can be due to an accumulation of deposits on heat exchanger tubing, as stated in GALL Report Section IX.F, visual inspections of the cooler tube outside surfaces are capable of identifying deposits, as well as particulate and other airborne debris associated with this aging effect. On the basis of its review, the staff finds that, because periodic visual inspections performed as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be capable of detecting loss of material and reduction in heat transfer, this program will adequately manage these aging effects when these components are exposed to air-indoor uncontrolled (internal and external).

In LRA Table 3.4.2-2, the applicant stated that copper and copper alloy piping, piping components, piping elements, and tanks exposed to air-indoor uncontrolled (internal) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.4.2-7, the applicant stated that the copper and copper alloy motor-driven emergency feedwater pump motor cooler components exposed to air-indoor uncontrolled (external) and raw water (external) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. In LRA Table 3.4.2-9, the applicant stated that the copper and copper alloy piping, piping components, and piping elements exposed to steam (internal) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note J. In LRA Table 3.4.2-10, the applicant stated that the copper and copper alloy seal water return pumps exposed to treated water (internal) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The applicant cited note D for this AMR item; however, the staff's evaluation that follows is applicable.

The staff noted that the applicant has appropriately identified loss of material due to selective leaching as being an applicable aging effect for copper and copper alloys exposed to an air, fuel oil, steam, and raw water environment. The staff noted that in these environments, there exist conditions such as high temperatures, moisture, stagnant-flow conditions, and corrosive environments such as acidic solutions and dissolved oxygen, which are conducive to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program, and its evaluation is documented in SER Section 3.0.3.2.10. The staff noted that the applicant's program includes examinations that will determine whether loss of material due to selective leaching is occurring from a sample population. The staff determined that if there is evidence that would indicate the presence of loss of material due to selective leaching, it will result in a sample expansion and engineering evaluation. The staff noted that the examinations being performed will consist of a visual examination supplemented by mechanical testing such as scraping or chipping to detect if loss of material due to selective leaching has occurred. The staff noted that loss of material due to selective leaching has an overall effect in reducing the fundamental integrity of the material with greatly reduced mechanical strength which can potentially collapse under normal working stresses. The staff further noted that a visual examination supplemented by mechanical testing, such as scraping or chipping, would identify indications of selective leaching. On the basis of its review, the staff finds that because this program includes a visual inspection supplemented by mechanical testing, such as scraping or chipping, which is capable of detecting loss of material due to selective leaching, this program will adequately manage loss of material due to selective leaching when these components are exposed to air-indoor uncontrolled (external and internal), treated water (internal), steam (internal), and raw water (external).

The staff's evaluation for gray cast iron piping, piping components, and piping elements exposed to air-indoor uncontrolled (internal) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program is documented in SER Section 3.3.2.3.15.

In LRA Table 3.4.2-2, the applicant stated that stainless steel piping, piping components, piping elements, and tanks exposed to steam internally subject to cumulative fatigue damage due to fatigue is a TLAA as defined in 10 CFR 54.3. In LRA Table 3.4.2-3, the applicant stated that stainless steel low-pressure feedwater heaters exposed to steam externally and stainless steel piping, piping components, piping elements, and tanks exposed to treated water internally subject to cumulative fatigue damage due to fatigue is a TLAA. In LRA Table 3.4.2-8, the applicant stated that stainless steel feedwater heaters exposed to steam externally, stainless steel flow restricting elements, flow restricting orifice housing/plates, piping, piping components, piping elements, and tanks exposed to treated water internally and system strainer screens/elements exposed to treated water externally subject to cumulative fatigue damage due to fatigue is a TLAA. In LRA Table 3.4.2-9, the applicant stated that stainless steel flow restricting orifice housing/plates exposed to treated water internally and stainless steel gland steam condenser components and system strainer screens/elements exposed to steam externally subject to cumulative fatigue damage due to fatigue is a TLAA. In LRA Table 3.4.2-10, the applicant stated that stainless steel flow restricting orifice housing/plates, piping, piping components, and piping elements exposed to treated water internally and stainless steel system strainer screens/elements exposed to treated water externally subject to cumulative fatigue damage due to fatigue is a TLAA. In LRA Table 3.4.2-12, the applicant stated that stainless steel containment isolation piping and components exposed to steam internally and treated water internally; stainless steel expansion joints, piping, piping components, piping elements, and tanks exposed to steam internally, and stainless steel piping, piping components, piping elements, and tanks exposed to treated water internally subject to cumulative fatigue damage due to fatigue is a TLAA. In LRA Table 3.4.2-14, the applicant stated that stainless steel flow restricting elements exposed to treated water internally subject to cumulative fatigue damage due to fatigue is a TLAA.

The staff noted that TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff further noted that the evaluations of these TLAAs are separately addressed in LRA Section 4.3. The AMR line items cite generic note J.

The staff noted that it was unclear whether LRA Section 4.3 has covered fatigue TLAA for the following components from the applicant's AMR line items: EFP-3 diesel engine exhaust expansion joints and silencers, standpipes, hydrants, and tanks; deaerator, expansion joints, feedwater booster pumps, tanks, feedwater heaters, main feedwater pumps.

The staff reviewed LRA Section 4.3 but was not able to locate the discussion for these AMR line items. By letter dated September 11, 2009, the staff issued RAI 3.3.2.2.1-1 requesting that the applicant identify the subsections of LRA Section 4.3 that discuss these components and provide the methods used for the TLAA analysis for these components.

The staff's review of RAI 3.3.2.2.1-1 and its evaluation and acceptance of the applicant's response are documented in SER Section 3.3.2.2.1.

The staff verified that in LRA Section 4.3.2.2, the applicant provided its fatigue TLAA evaluation for components included in this section. The staff's evaluation of this TLAA, USAS B31.1.0 Piping - Non-Class 1 components, is documented in SER Section 4.3.2.2.2.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR in LRA Table 3.4.2-2 for carbon or low alloy steel piping, piping elements, piping components, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, evaporative cooler coils and components, instrument and station air receivers, and tanks exposed to raw water which are being managed for loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Condensate System-Summary of Aging Management Review–LRA Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the condensate system component groups.

In LRA Tables 3.4.2-3 and 3.4.2-7, the applicant stated that the carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program. The AMR line items cite generic note J.

The staff evaluated the AMR items in comparison with the GALL Report. In its review, the staff noted that GALL Report Volume 2, Tables VIII.A through VIII.I for the steam and power conversion system describe one AMR item for the loss of preload under item VIII.H-5. In comparison with the applicant's AMR items exposed to air–outdoor, the staff noted that GALL Report item VIII.H-5 addresses the loss of preload of steel bolting exposed to air-indoor uncontrolled (external) and the GALL Report recommends GALL AMP XI.M18, "Bolting Integrity," to manage the aging effect of the AMR item. Based on its review, the staff finds that the applicant's claim of note J is relevant because the loss of preload of the bolting exposed to outdoor air is not addressed in the GALL Report.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.2.2. The staff finds the applicant's currently proposed AMP acceptable because the applicant's program manages loss of preload through the proper selection of bolting and gasket materials, preload control, and compliance with the bolting installation guidance recommended in the GALL Report, and the GALL Report recommends the Bolting Integrity Program to manage the loss of preload of the steel bolting exposed to air-indoor uncontrolled, which is an environment similar to that of the AMR items.

In LRA Table 3.4.2-3, the applicant stated that stainless steel condenser hotwell strainers exposed to treated water are being managed for flow blockage due to fouling by the Water Chemistry and One-Time Inspection programs. The applicant cited generic note J.

The staff reviewed the applicant's Water Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant stated that the Water Chemistry Program provides for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits as defined by EPRI Water Chemistry Guidelines, and the One-Time Inspection Program is credited to perform inspections to verify the effectiveness of the Water Chemistry Program. On this basis, the staff finds the applicant's Water Chemistry and One-Time Inspection programs acceptable to manage flow blockage due to fouling of stainless steel condenser hotwell strainers exposed to treated water.

In LRA Tables 3.4.2-3 and 3.4.2-7, the applicant stated that the internal surfaces of elastomers in expansion joints, piping, piping components, piping elements, and tanks exposed to treated water and outdoor air are being managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components. The applicant cited generic note J. The staff noted that GALL Report Sections IX.E and IX.F jointly state that the appropriate aging effect for elastomeric materials is hardening and loss of strength.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. In its review of these items, the staff noted that the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components has been expanded from the corresponding GALL Report AMP to include materials other than steel and test methods other than visual. The staff also noted that the LRA AMP includes elastomers and includes physical manipulation and other investigative methods designed specifically to detect hardening and loss of strength in elastomers. The staff finds the applicant's currently proposed use of this AMP to manage the aging effects for these AMR line items acceptable because the LRA program will be capable of detecting the aging effect under consideration because appropriate inspection techniques such as visual inspection and physical manipulation are included in the program.

In LRA Tables 3.4.2-3 and 3.4.2-7, the applicant stated that the external surfaces of elastomers in expansion joints, piping, piping components, piping elements, and tanks exposed to outdoor air and uncontrolled indoor air are being managed for hardening and loss of strength due to elastomers and plastic degradation and loss of material due to wear by the External Surfaces Monitoring Program. The AMR line items cite generic note J.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. In its review of these items, the staff noted that the applicant has committed to enhancing its External Surfaces Monitoring Program to include elastomers. The staff also noted that loss of material from elastomers due to wear can be detected by visual means. The staff further noted that visual inspections suitable for detection of loss of material due to wear are an inherent part of the applicant's External Surfaces Monitoring Program. The staff finds the applicant's currently proposed use of this AMP to manage the aging effects for these AMR line items acceptable because the program uses visual inspection methods that are capable of detecting loss of material due to wear.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air subject to hardening and loss of strength due to elastomer and plastic degradation, with generic note J, is documented in SER Section 3.3.2.3.22.

In LRA Tables 3.4.2-3 and 3.4.2-7, the applicant stated that carbon or low alloy steel low pressure feedwater heaters, main condensers, and turbine-driven emergency feedwater pump turbine governor lube oil cooler components exposed to treated water are being managed for loss of material due to galvanic corrosion using the Water Chemistry Program and the One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed all AMR line items in the GALL Report for this component and material combination and noted that in the condensate system in the GALL Report, under item VIII.E-7, the Water Chemistry Program augmented by the One-Time Inspection program are recommended to manage loss of material due to general, pitting, crevice, and galvanic corrosion of steel heat exchanger components exposed to treated water. The staff reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff finds the proposed AMPs acceptable to manage aging for these components because the Water Chemistry Program monitors and controls the concentration of contaminants in the water in order to minimize corrosion and the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program by visual inspection, which is consistent with the GALL Report recommendations.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to steam and treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

In LRA Tables 3.4.2-3 and 3.4.2-8, the applicant stated that stainless steel feedwater heaters and main condensers exposed to steam are being managed for loss of material due to crevice and pitting corrosion and cracking due to SCC by the Water Chemistry and One-Time Inspection programs. The applicant cited generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because, as identified in GALL Report items VIII.A-11 and VIII.A-12, stainless steel components in a steam environment are susceptible to loss of material and SCC. The staff noted that no other aging effects for stainless components in a steam environment were identified in the GALL Report.

The staff reviewed the applicant's Water Chemistry and One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant stated that the Water Chemistry Program provides for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits, as defined by EPRI water chemistry guidelines, thus minimizing the occurrence and effects of pitting and crevice corrosion and SCC; and the One-Time Inspection Program is credited to perform inspections to verify the effectiveness of the Water Chemistry Program. On this basis, the staff finds the applicant's Water Chemistry and One-Time Inspection programs acceptable to manage SCC and loss of material due to pitting and crevice corrosion of stainless steel components exposed to steam.

In LRA Table 3.4.2-3, the applicant stated that the titanium main condenser and tubes exposed to raw water (internal) are being managed for cracking due to SCC, flow blockage due to fouling, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because titanium is susceptible to SCC in certain environmental conditions, and flow blockage and reduction in heat transfer due to fouling are potential effects for raw water applications. In addition, the staff noted that in oxygenated environments like raw water, titanium is resistant to pitting, crevice, and general corrosion due to its formation of stable, continuous, highly adherent, and protective oxide films on its surfaces.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The staff noted that GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," recommends the use of visual inspections of internal surfaces to manage the loss of material due to various corrosion mechanisms and fouling of steel components that are not covered by other AMPs. The staff finds the applicant's currently proposed AMP acceptable for managing flow blockage due to fouling and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces because it requires periodic visual inspections of the component internal surfaces that are capable of detecting corrosion, corrosion byproducts, discoloration on the surface, scale/deposits, and surface discontinuities that are indicative of flow blockage due to fouling and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces. However, the staff noted that the AMR line items indicate that the applicant's AMP has expanded its scope of aging effects to include cracking due to SCC, which is beyond the scope of GALL AMP XI.M38.

By letter dated December 1, 2009, the staff issued RAI B.2.23-1 requesting that the applicant justify the effectiveness of its program in managing cracking due to SCC of the titanium components.

In its response dated December 30, 2009, the applicant stated that its AMP will use enhanced visual and/or volumetric inspection methods, as recommended in GALL AMP XI.M32, "One-Time Inspection," to detect stress corrosion cracks. The staff finds the applicant's response and currently proposed AMP acceptable for managing cracking due to SCC because use of enhanced visual and/or volumetric inspection methods is capable of detecting stress corrosion cracks and is consistent with the recommendations in GALL AMP XI.M32. The staff's concern described in RAI B.2.23-1 is resolved.

In LRA Table 3.4.2-3, the applicant stated that the titanium main condenser and tubes exposed to treated water (external) are being managed for cracking due to SCC, loss of material due to crevice corrosion, and reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Water Chemistry Program and One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because titanium is susceptible to SCC in certain environmental conditions and although not a significant concern, reduction in heat transfer due to fouling is a potential effect for closed-cycle cooling water environments. In addition, the staff noted that in a non-oxygen environment, like closed-cycle cooling water, the oxide film on titanium will not reform if damaged, making it susceptible to crevice corrosion.

The staff reviewed the Water Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff finds the applicant's Water Chemistry Program acceptable because it requires periodic monitoring and control of water chemistry for impurities (e.g., dissolved oxygen, chlorides, fluorides, and sulfates) that accelerate corrosion, cracking, and fouling. The staff finds that controlling the water chemistry creates an environment that is not conducive for corrosion and cracking to occur. Furthermore, the applicant's One-Time Inspection Program will perform an appropriate NDE examination to detect loss of material, cracking, and reduction of heat transfer effectiveness due to fouling to verify the effectiveness of its chemistry control.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

In LRA Tables 3.4.2-3 and 3.4.2-6, the applicant stated that carbon or low alloy steel piping, piping components, piping elements, and tanks exposed to treated water are being managed for loss of material due to galvanic corrosion by the Water Chemistry and One-Time Inspection programs. The AMR line items cite generic note J.

The staff reviewed the Water Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant stated that these programs will provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits defined by the EPRI Water Chemistry Guidelines and will perform one-time inspections of components subjected to the treated water to detect material loss. The staff finds the Water Chemistry and One-Time Inspection programs acceptable to manage material loss due to galvanic corrosion for carbon or low alloy steel components exposed to treated water because water chemistry control verified by a one-time inspection is an appropriate method to manage this aging degradation.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air-outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

In LRA Tables 3.4.2-3 and 3.4.2-7, the applicant stated that the carbon or low alloy steel piping, piping components, piping elements, and tanks exposed to soil are being managed for loss of material due to galvanic corrosion by the Buried Piping and Tanks Inspection Program. The AMR line items cite generic note H.

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.1.10. The staff finds the applicant's proposal to manage aging using the Buried Piping and Tanks Inspection Program acceptable because the corrosion rate for galvanic corrosion is lower than the most rapid corrosion (MIC) rate included in this GALL Report item and because galvanic corrosion can be detected by the same methods (visual examination) as the corrosion mechanism included in this item. The staff accepts that the additional corrosion mechanism identified is sufficiently similar to those actually included in SRP-LR Table 3.4.1, item 11 so as not to render it inconsistent with the GALL Report.

The staff's evaluation for fiberglass or fiber-reinforced plastic components exposed to treated water or raw water on the interior and air – outdoor on the exterior which are being managed for loss of strength due to elastomer/plastic degradation by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and External Surfaces Monitoring programs, with generic note J, is documented in SER Section 3.4.2.3.1.

In LRA Table 3.4.2-3, the applicant stated that stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air are being managed for loss of material due to crevice or pitting corrosion by the External Surfaces Monitoring Program. The applicant cited generic note J.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The applicant stated that the External Surfaces Monitoring Program performs periodic visual inspections of components. The staff finds the applicant's External Surfaces Monitoring Program acceptable to manage loss of material due to crevice or pitting corrosion of stainless steel components exposed to outdoor air because visual inspection is an acceptable technique to detect this aging effect.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air

Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Once-Through Steam Generator Chemical Cleaning System-Summary of Aging Management Review–LRA Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the once-through steam generator chemical cleaning system component groups.

In LRA Table 3.4.2-4, the applicant stated that stainless steel piping, piping components, piping elements, tanks, and containment isolation piping and components exposed to treated water are being managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note J.

The staff reviewed the GALL Report and found that there are AMR line items for stainless steel piping, piping components, piping elements, tanks, and containment isolation piping and components exposed to treated water in the GALL Report for which the Water Chemistry and One-Time Inspection programs are recommended. The staff was unsure how the applicant's proposed AMP was adequate to manage the effects of aging. Therefore, by letter dated December 1, 2009, the staff issued RAI 3.4.2.4-1 requesting that the applicant justify how the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage loss of material in stainless steel piping exposed to treated water.

By letter dated December 30, 2009, the applicant responded to RAI 3.4.2.4-1 and stated that due to the system's operating characteristics, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was chosen to manage the aging of the subject components. The proposed AMP will be implemented via existing preventive maintenance, surveillance testing, and periodic testing work order tasks that provide opportunities for the visual inspection of internal surfaces of piping. Periodic internal inspections of components allow timely detection of degradation and the determination of appropriate corrective actions. This AMP's work activities will monitor parameters that may be detected by visual examination, such as loss of material due to pitting and crevice corrosion, by inspecting for discontinuities and imperfections on the surface of the component. The extent and schedule of inspections and testing assure detection of component degradation prior to loss of intended function. The staff finds the applicant's response acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will be able to detect and manage the aging effects of concern. The staff's concern described in RAI 3.4.2.4-1 is resolved.

The staff reviewed the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. The applicant stated that this program performs periodic visual inspections to identify loss of material and fouling. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage loss of material due to pitting and crevice corrosion for these components because visual inspection is an acceptable technique to detect this aging effect.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.5 Condensate and Feedwater Chemical Cleaning System - Summary of Aging Management Review – LRA Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the condensate and feedwater chemical cleaning system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.4.2.3.6 Condensate Demineralizer System-Summary of Aging Management Review– LRA Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarizes the results of AMR evaluations for the condensate demineralizer system component groups.

The staff's evaluation for aluminum, piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, and tanks exposed to treated water which are being managed for loss of material due to galvanic corrosion by the Water Chemistry and One-Time Inspection programs, with generic note H, is documented in SER Section 3.4.2.3.3.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.7 Emergency Feedwater System-Summary of Aging Management Review– LRA Table 3.4.2-7

The staff reviewed LRA Table 3.4.2-7, which summarizes the results of AMR evaluations for the emergency feedwater system component groups.

The staff's evaluation for carbon or low alloy steel/stainless steel closure bolting exposed to outdoor air (external) which is being managed for loss of preload due to thermal effects, gasket creep, and self-loosening by the Bolting Integrity Program, with generic note J, is documented in SER Section 3.4.2.3.3.

The staff's evaluation for copper and copper alloy piping, piping components, piping elements, tanks, and motor-driven emergency feedwater pump motor cooler components exposed to air – indoor uncontrolled (internal and external) which are being managed for loss of material due to pitting and crevice corrosion and copper and copper alloy motor-driven emergency feedwater pump motor cooler tubes exposed to air – indoor uncontrolled (external) which are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (internal), raw water (external), steam (internal), and treated water (internal) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to raw water (external) which are being managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.4.2.3.1.

The applicant proposed to manage reduction of heat transfer effectiveness due to fouling of heat transfer surfaces of aluminum motor cooler tubes exposed to an indoor uncontrolled air environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The LRA indicates that neither the components nor the material and environment combination is evaluated in the GALL Report.

The staff noted that GALL Report item III.B1.1-6 recommends no AERMs for aluminum components exposed to indoor uncontrolled air. The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.12. The staff finds that the credited AMP is appropriate because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program implements periodic inspections of the component internal surfaces with an extent and schedule of inspections and testing adequate to assure detection of component degradation prior to loss of intended functions.

In LRA Tables 3.4.2-7, 3.4.2-8, and 3.4.2-11, the applicant stated that stainless steel motor-driven emergency feedwater pump gear oil cooler components, turbine-driven emergency feedwater pump turbine governor lube oil cooler components, auxiliary feedwater pump bearing cooling housing and components and piping, piping components, piping elements, and strainers exposed to lubricating oil are being managed for cracking due to SCC and flow blockage due to fouling by the Lubricating Oil Analysis Program and the One-Time Inspection Program. The applicant cited generic note J.

The staff reviewed the applicant's Lubricating Oil Analysis Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.12 and 3.0.3.1.9, respectively. The applicant indicated that these programs provide for periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thus reducing the occurrence and effects of cracking and flow blockage, and will perform a one-time inspection of components exposed to lubricating oil to confirm the effectiveness of the Lubricating Oil Analysis Program. The staff noted that a one-time inspection is an acceptable method to determine whether or not cracking and flow blockage are occurring. On this basis, the staff finds the applicant's Lubricating Oil Analysis Program and the One-Time Inspection Program acceptable because the program maintains oil system contaminants within acceptable limits, thereby preserving an environment that is not conducive to cracking and flow blockage.

In LRA Table 3.4.2-7, the applicant stated that stainless steel motor-driven emergency feedwater pump gear oil cooler components exposed to closed-cycle cooling water (external) are being managed for SCC by the Closed-Cycle Cooling Water System Program. The AMR line item cites generic note H.

The staff's evaluation of the applicant's Closed-Cycle Cooling Water System Program is documented in SER Section 3.0.3.2.4. The staff finds the applicant's proposal to manage aging using the Closed-Cycle Cooling Water System Program acceptable because the program contains controls for chemistry, testing, and inspection consistent with the EPRI standards recommended by the GALL Report.

The staff's evaluation for carbon or low alloy steel low pressure feedwater heaters, main condensers, and turbine-driven emergency feedwater pump turbine governor lube oil cooler components exposed to treated water which are being managed for loss of material due to galvanic corrosion using the Water Chemistry Program and the One-Time Inspection Program, with generic note J, is documented in SER Section 3.4.2.3.3.

In LRA Table 3.4.2-7, the applicant stated that the stainless steel turbine-driven emergency feedwater pump turbine governor lube oil cooler components exposed to treated water are being managed for cracking due to SCC by the Water Chemistry Program and the One-Time Inspection Program. The applicant cited generic note J.

The staff reviewed the GALL Report and concluded that, while this AMR line item is not in the GALL Report under the auxiliary feedwater system, it is in the feedwater system under item VIII.D1-5. GALL Report item VIII.D1-5 recommends the Water Chemistry Program augmented with the One-Time Inspection Program. The staff reviewed the applicant's Water Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant indicated that these programs provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits, as defined by EPRI Water Chemistry Guidelines, thus reducing the occurrence and effects of SCC, and will perform a one-time inspection of components to verify the effectiveness of the Water Chemistry Program. On this basis, the staff finds the applicant's Water Chemistry and One-Time Inspection programs acceptable to manage SCC of stainless steel components exposed to treated water.

The staff's evaluation for piping insulation exposed to uncontrolled indoor and outdoor air with no aging effects, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for carbon or low alloy steel for diesel exhaust silencers, piping, piping components, piping elements, and tanks exposed to air – outdoor (external) which are being managed for loss of material due to galvanic corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.33.

The staff's evaluation for carbon or low alloy steel components exposed to soil subject to loss of material due to galvanic corrosion which are being managed by the Buried Piping and Tanks Inspection Program, with generic note H, is documented in SER Section 3.4.2.3.3.

In LRA Table 3.4.2-7, the applicant stated that the internal surfaces of elastomers in piping, piping components, piping elements, and tanks exposed to outdoor air are being managed for hardening and loss of strength and loss of material due to wear by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff noted that GALL Report Sections IX.E and IX.F jointly state that the appropriate aging effect for elastomeric materials is hardening and loss of strength. The staff also noted that GALL Report Section IX.F states that wear can occur due to removal of surface layers from the influence of hard abrasive particles which could be applicable due to the contents of the emergency feedwater makeup water sources.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.12. In its review of these items, the staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program has been expanded from the corresponding GALL Report AMP to include materials other than steel and test methods other than visual. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes elastomers and includes physical manipulation and other investigative methods designed specifically to detect aging of elastomers. The staff finds the applicant's currently proposed use of this AMP to manage the aging effects for these AMR line items acceptable because the LRA program will be capable of detecting the aging effect under consideration because appropriate inspection techniques such as visual inspection and physical manipulation are included in the program.

The staff's evaluation for elastomer components exposed to outdoor air and uncontrolled indoor air subject to hardening and loss of strength which are being managed by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.4.2.3.3.

The staff's evaluation for elastomer components exposed externally to outdoor air and uncontrolled indoor air subject to loss of material due to wear which are being managed by the External Surfaces Monitoring Program, with generic note J, is documented in SER Section 3.4.2.3.3.

The staff's evaluation for elastomer components exposed internally to outdoor air and treated water subject to hardening and loss of strength which are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with generic note J, is documented in SER Section 3.4.2.3.3.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be

adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.8 Main Feedwater System-Summary of Aging Management Review–LRA Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarizes the results of AMR evaluations for the main feedwater system component groups.

The staff's evaluation for stainless steel motor-driven emergency feedwater pump gear oil cooler components, turbine-driven emergency feedwater pump turbine governor lube oil cooler components, auxiliary feedwater pump bearing cooling housing and components and piping, piping components, piping elements, and strainers exposed to lubricating oil which are being managed for SCC by the Lubricating Oil Analysis Program and the One-Time Inspection Program, with generic note J, is documented in SER Section 3.4.2.3.7.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to treated water and steam subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for stainless steel feedwater heaters and main condensers exposed to steam which are being managed for loss of material due to pitting and crevice corrosion and cracking due to SCC by the Water Chemistry and One-Time Inspection programs, with generic note J, is documented in SER Section 3.4.2.3.3.

The staff's evaluation for piping insulation exposed to uncontrolled indoor and outdoor air with no aging effects, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.9 Gland Steam System-Summary of Aging Management Review–LRA Table 3.4.2-9

The staff reviewed LRA Table 3.4.2-9, which summarizes the results of AMR evaluations for the gland steam system component groups.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to diesel exhaust, treated water, and steam subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

In LRA Table 3.4.2-9, the applicant stated that carbon or low alloy steel gland steam condenser components exposed to steam are being managed for loss of material due to general corrosion using the Water Chemistry Program. The AMR line item cites generic note J.

The staff reviewed all AMR result lines in the GALL Report for this component and material combination and noted that the GALL Report, under item VIII.A-15, recommends the use of the Water Chemistry Program augmented by the One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to steam. It is not clear to the staff how the Water Chemistry Program alone will provide adequate aging management for loss of material due to general corrosion for carbon or low alloy steel gland steam condenser components exposed to steam.

By letter dated December 1, 2009, the staff issued RAI 3.4.2.2-1 requesting that the applicant provide justification as to why a One-Time Inspection Program is not necessary to manage general corrosion of the carbon or low alloy steel gland steam condenser components. In its response dated December 30, 2009, the applicant stated that the AMR line items are aligned to GALL Report item VIII.B1-8 in which only the Water Chemistry Program is recommended to manage loss of material due to pitting and crevice corrosion of steel piping, piping components, and piping elements exposed to steam. The applicant also stated that the steel gland steam condenser components are ultrasonically tested periodically for flow-accelerated corrosion by its Flow-Accelerated Corrosion Program and that the applicant's operating experience reviews have not identified general corrosion of carbon steel as applicable on the internal surfaces of the gland steam condenser components. The staff noted that GALL Report item VIII.B1-8 is applicable to PWR main steam system components and is appropriate to manage aging for gland steam condenser components. The staff finds the applicant's response acceptable because the components are tested for flow-accelerated corrosion, the applicant's operating experience confirms that corrosion is not occurring, and the AMR item is consistent with GALL Report item VIII.B1-8. The staff's concern described in RAI 3.4.2.2-1 is resolved.

In LRA Table 3.4.2-9, the applicant stated that carbon or low alloy steel gland steam condenser components exposed to treated water are being managed for loss of material due to galvanic corrosion using the Water Chemistry Program and the One-Time Inspection Program. The AMR line item cites generic note J.

The staff reviewed AMR result lines in the GALL Report for this component and material combination and noted that in the condensate system in the GALL Report, under item VIII.E-7, the Water Chemistry Program augmented by the One-Time Inspection Program are recommended to manage loss of material due to general, pitting, crevice, and galvanic corrosion of steel heat exchanger components exposed to treated water. The staff reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program, which are evaluated in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff finds the proposed AMPs acceptable to manage aging for these components because the Water Chemistry Program monitors and controls the concentration of contaminants in the water in order to minimize corrosion and the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program by visual inspection, which is consistent with the GALL Report recommendations.

In LRA Table 3.4.2-9, the applicant stated that stainless steel gland steam condenser tubes exposed to steam are being managed for reduction of heat transfer effectiveness due to fouling of heat transfer surfaces by the Water Chemistry and One-Time Inspection programs. The applicant cited generic note J.

The staff reviewed the associated items in the LRA and confirmed that the applicant has identified the correct aging effects for this component, material, and environment combination because, although not a significant concern for stainless steel, reduction in heat transfer due to fouling may be a potential effect for steam environments. In addition, the staff noted that the other potential aging effects for this material and environment combination, which include loss of material and SCC, are addressed in the LRA through GALL Report items VIII.B1-2 and VIII.B1-3.

The staff reviewed the applicant's Water Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The applicant indicated that these programs provide for periodic sampling and analysis of water chemistry to maintain contaminants within acceptable limits, as defined by EPRI guidelines, thus limiting the occurrence of fouling, and will perform a one-time inspection of components to confirm the effectiveness of the Water Chemistry Program. On this basis, the staff finds the applicant's Water Chemistry and One-Time Inspection programs acceptable to manage reduction of heat transfer effectiveness for these components.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, tanks, containment isolation piping, expansion joints, and system strainer screens and elements exposed to steam which are being managed for loss of material due to general corrosion by the Water Chemistry Program, with generic note H, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external), raw water (external), steam (internal), and treated water (internal) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note J, is documented in SER Section 3.4.2.3.2.

In LRA Table 3.4.2-9, the applicant stated that the copper and copper alloy piping, piping components, and piping elements exposed to steam (internal) are being managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program supplemented by the One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.2 and 3.0.3.1.9, respectively. The staff determined that the Water Chemistry Program includes activities to mitigate aging effects on component surfaces by controlling water chemistry for impurities such as dissolved oxygen, chlorides, fluorides, and sulfates that can potentially accelerate corrosion and cracking. The staff further determined that this program relies on monitoring and control of water chemistry in order to keep the peak levels of various impurities below the specified limits. Furthermore, the applicant may add chemical agents, such as corrosion inhibitors, oxygen scavengers, and biocides, to prevent certain aging mechanisms.

The staff noted that the applicant's program is based on the latest revision of the EPRI water chemistry guidelines and will continue to update the program as new revisions of this guideline is released. The staff noted that the applicant's One-Time Inspection Program will also verify the effectiveness of its Water Chemistry Program. On the basis of its review, the staff finds that because impurities that can promote corrosion and cracking will be maintained and controlled for these components by the Water Chemistry Program and will be supplemented by the One-Time Inspection Program to confirm the effectiveness of the chemistry program, these programs will adequately manage loss of material due to pitting and crevice corrosion when these components are exposed to steam (internal).

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.10 Gland Seal Water System-Summary of Aging Management Review–
LRA Table 3.4.2-10

The staff reviewed LRA Table 3.4.2-10, which summarizes the results of AMR evaluations for the gland seal water system component groups.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to diesel exhaust, treated water, and steam subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

The staff's evaluation for copper and copper alloy components exposed to air – indoor uncontrolled (external), raw water (external), steam (internal), and treated water (internal) which are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program, with generic note D, is documented in SER Section 3.4.2.3.2.

By letter dated September 18, 2009, the applicant submitted LRA Amendment No. 3 which included an AMR in LRA Table 3.4.2-10 for carbon or low alloy steel piping, piping components, and piping elements exposed to raw water which are being managed for loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The AMR line items cite generic note J. The staff's evaluation is documented in SER Section 3.3.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL

Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.11 Main Feedwater Turbine Lube Oil System-Summary of Aging Management Review–LRA Table 3.4.2-11

The staff reviewed LRA Table 3.4.2-11, which summarizes the results of AMR evaluations for the main feedwater turbine lube oil system component groups.

The staff's evaluation for stainless steel motor-driven emergency feedwater pump gear oil cooler components, turbine-driven emergency feedwater pump turbine governor lube oil cooler components, auxiliary feedwater pump bearing cooling housing and components and piping, piping components, piping elements, and strainers exposed to lubricating oil which are being managed for SCC by the Lubricating Oil Analysis Program and the One-Time Inspection Program, with generic note J, is documented in SER Section 3.4.2.3.7.

The staff's evaluation for stainless steel strainers exposed to a lubricating oil environment which are being managed for cracking due to SCC and flow blockage due to fouling by the Lubricating Oil Analysis and One-Time Inspection programs, with generic note J, is documented in SER Section 3.3.2.3.30

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.12 Main Steam System-Summary of Aging Management Review–LRA Table 3.4.2-12

The staff reviewed LRA Table 3.4.2-12, which summarizes the results of AMR evaluations for the main steam system component groups

The staff's evaluation for carbon or low alloy steel piping, piping components, piping elements, tanks, containment isolation piping, expansion joints, and system strainer screens and elements exposed to steam which are being managed for loss of material due to general corrosion by the Water Chemistry Program, with generic note H, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to treated water and steam subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for piping insulation exposed to uncontrolled indoor and outdoor air, with no aging effects, with generic note J, is documented in SER Section 3.4.2.3.2.

The staff's evaluation for aluminum piping, piping components, piping elements, and tanks exposed to dried air with no AERMs, with generic note J, is documented in SER Section 3.4.2.3.1.

By letter dated November 12, 2010, the applicant amended the LRA to include steel, stainless steel, and copper and copper alloy piping, piping components, and piping elements exposed to a dried air environment, which are being managed for loss of material by the Compressed Air Monitoring Program, with generic note J. The staff's evaluation is documented in SER Section 3.2.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.13 Relief Valve Vent System-Summary of Aging Management Review–
LRA Table 3.4.2-13

The staff reviewed LRA Table 3.4.2-13, which summarizes the results of AMR evaluations for the relief valve vent system component groups.

The staff's evaluation for carbon, low alloy steel, and galvanized steel for diesel engine exhaust piping, piping components, piping elements, and tanks and Appendix R control complex chiller air cooled condenser components, evaporative cooler components, ducting and components, and containment isolation piping and components exposed to air – outdoor (external) which are being managed for loss of material due to pitting or crevice corrosion by the External Surfaces Monitoring Program, with generic note H, is documented in SER Section 3.3.2.3.18.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to treated water and steam subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.14 Secondary Plant System-Summary of Aging Management Review–
LRA Table 3.4.2-14

The staff reviewed LRA Table 3.4.2-14, which summarizes the results of AMR evaluations for the secondary plant system component groups.

The staff's evaluation for carbon or low alloy steel and stainless steel components exposed to treated water subject to cumulative fatigue damage which is a TLAA as defined in 10 CFR 54.3, with generic note J, is documented in SER Section 3.4.2.3.2.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.15 Cycle Startup System-Summary of Aging Management Review–LRA Table 3.4.2-15

The staff reviewed LRA Table 3.4.2-15, which summarizes the results of AMR evaluations for the cycle startup system component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Containments, Structures, and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the containments, structures, component supports and component groups of the following:

- reactor building
- auxiliary building
- wave embankment protection structure
- borated water storage tank foundation and shield wall
- cable bridge
- control complex
- intake and discharge canals
- circulating water discharge structure
- circulating water intake structure
- diesel generator building
- emergency feedwater pump building
- dedicated emergency feedwater tank enclosure building
- fire service pumphouse
- intermediate building
- machine shop

- miscellaneous structures
- switchyard for Crystal River site
- switchyard relay building
- turbine building

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the containment, structures, component supports and component groups. LRA Table 3.5.1, "Summary of Aging Management Programs for Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the structures and component support components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the structures and component support components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's evaluation are documented in SER Section 3.5.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.5.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.5.2.3.

For SSCs which the applicant claimed are not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to confirm the applicant's claims.

Table 3.5-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.5 and addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Structures and Component Supports Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
PWR Concrete (Reinforced and Prestressed) and Steel Containments					
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable) (3.5.1-1)	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack and corrosion of embedded steel	ISI (IWL), and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater if environment is non-aggressive. A plant-specific program is to be evaluated if the environment is aggressive.	Yes	ASME Section XI, Subsection IWL Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Concrete elements: All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a dewatering system is relied upon for control of settlement, then the applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete elements: foundation, subfoundation (3.5.1-3)	Reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a dewatering system is relied upon to control erosion of cement from porous concrete subfoundations, then the applicant is to ensure proper functioning of the dewatering system through the period of extended operation.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.1)
Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable) (3.5.1-4)	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.1)
Steel elements: drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable) (3.5.1-5)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)
Steel elements: steel liner, liner anchors, and integral attachments (3.5.1-6)	Loss of material due to general pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes	ASME Section XI, Subsection IWE Program, and 10 CFR 50, Appendix J Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Prestressed containment tendons (3.5.1-7)	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers (3.5.1-8)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-9)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations and evaluations for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.1)
Stainless steel vent line bellows (3.5.1-11)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination and evaluation for bellows assemblies and dissimilar metal welds.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-12)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks.	Yes	ASME Section XI, Subsection IWE Program and 10 CFR Part 50, Appendix J Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers (3.5.1-13)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable) (3.5.1-14)	Loss of material (scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.1)
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, and concrete fill-in annulus (as applicable) (3.5.1-15)	Cracking due to expansion and reaction with aggregate; increase in porosity and permeability due to leaching of calcium hydroxide	ISI (IWL) for accessible areas. None for inaccessible areas, if concrete was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R.	Yes	ASME Section XI, Subsection IWL Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Seals, gaskets, and moisture barriers (3.5.1-16)	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ASME Section XI, Subsection IWE Program, and 10 CFR 50, Appendix J Program	Consistent with GALL Report.
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms (3.5.1-17)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	10 CFR Part 50, Appendix J and plant TS	No	10 CFR 50, Appendix J Program	Consistent with GALL Report.
Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch, and control rod drive (CRD) hatch (3.5.1-18)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ASME Section XI, Subsection IWE Program, and 10 CFR 50, Appendix J Program	Consistent with GALL Report.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: stainless steel suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Steel elements: suppression chamber liner (interior surface) (3.5.1-20)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Steel elements: drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	No	ASME Section XI, Subsection IWE Program	Consistent with GALL Report.
Safety-Related and Other Structures; and Component Supports					
All Groups except Group 6: interior and above-grade exterior concrete (3.5.1-23)	Cracking, loss of bond, and loss of material (spalling and scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
All Groups except Group 6: interior and above-grade exterior concrete (3.5.1-24)	Increase in porosity and permeability, cracking, loss of material (spalling and scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
All Groups except Group 6: steel components, all structural steel (3.5.1-25)	Loss of material due to corrosion	Structures Monitoring Program. If protective coatings are relied upon to manage the effects of aging, the Structures Monitoring Program is to include provisions to address protective coating, monitoring, and maintenance.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
All Groups except Group 6: accessible and inaccessible concrete, foundation (3.5.1-26)	Loss of material (spalling and scaling) and cracking due to freeze-thaw	Structures Monitoring Program. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)
All Groups except Group 6: accessible and inaccessible interior and exterior concrete (3.5.1-27)	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: All (3.5.1-28)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a dewatering system is relied upon for control of settlement, then the applicant is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: foundation (3.5.1-29)	Reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a dewatering system is relied upon for control of settlement, then the applicant is to ensure proper functioning of the dewatering system through the period of extended operation.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 4: radial beam seats in BWR drywell; reactor pressure vessel (RPV) support shoes for PWR with nozzle supports; steam generator supports (3.5.1-30)	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)
Groups 1-3, 5, 7-9: below-grade concrete components, such as below-grade exterior walls and foundation (3.5.1-31)	Increase in porosity and permeability, cracking, loss of material (spalling and scaling), aggressive chemical attack; cracking, loss of bond, and loss of material (spalling and scaling), and corrosion of embedded steel	Structures Monitoring Program. Examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes	Structures Monitoring Program	Consistent with GALL Report(See SER Section 3.5.2.2.2)
Groups 1-3, 5, 7-9: exterior above and below-grade reinforced concrete foundations (3.5.1-32)	Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide	Structures Monitoring Program for accessible areas; none for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Groups 1-5: concrete (3.5.1-33)	Reduction of strength and modulus due to elevated temperature	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: concrete, all (3.5.1-34)	Increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack; cracking, loss of bond, and loss of material due to corrosion of embedded steel	Inspection of Water-Control Structures or Federal Energy Regulatory Commission (FERC)/US Army Corps of Engineers (USACE) dam inspections and maintenance programs. For inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2) Structures Monitoring Program meets the requirements of GALL AMP XI.S7 “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants”
Group 6: exterior above- and below-grade concrete foundation (3.5.1-35)	Loss of material (spalling and scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: all accessible and inaccessible reinforced concrete (3.5.1-36)	Cracking due to expansion or reaction with aggregates	For accessible areas, Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)
Group 6: exterior above- and below-grade reinforced concrete foundation interior slab (3.5.1-37)	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2) Structures Monitoring Program meets the requirements of GALL AMP XI.S7 "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants"
Groups 7 and 8: tank liners (3.5.1-38)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.2.2)
Support members, welds, bolted connections, support anchorage to building structure (3.5.1-39)	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates (3.5.1-40)	Reduction in concrete anchor capacity due to local concrete degradation, service-induced cracking, or other concrete aging mechanisms	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes	Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.2.2)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds (3.5.1-42)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to CR-3. (See SER Section 3.5.2.2.2)
Groups 1-3, 5, 6: all masonry block walls (3.5.1-43)	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Masonry Wall Program	Consistent with GALL Report.
Group 6: elastomer seals, gaskets, and moisture barriers (3.5.1-44)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report.
Group 6: exterior above- and below-grade concrete foundation; interior slab (3.5.1-45)	Loss of material due to abrasion and cavitation	Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance	No	Structures Monitoring Program	Consistent with GALL Report. Structures Monitoring Program meets the requirements of GALL AMP XI.S7 "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants"
Group 5: fuel pool liners (3.5.1-46)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	Water Chemistry Control Program and monitoring of spent fuel pool water level in accordance with TS and leakage from the leak chase channels.	No	Water Chemistry Program	Consistent with GALL Report.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: all metal structural members (3.5.1-47)	Loss of material due to general (steel only), pitting, and crevice corrosion	Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Structures Monitoring Program	Consistent with GALL Report.
Group 6: earthen water control structures-dams, embankments, reservoirs, channels, canals, and ponds (3.5.1-48)	Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, and seepage	Inspection of Water-Control Structures or FERC/USACE dam inspections and maintenance programs	No	Structures Monitoring Program	Consistent with GALL Report. (See SER Section 3.5.2.1.2) Structures Monitoring Program meets the requirements of GALL AMP XI.S7 “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants”
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-49)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	Not applicable	Not applicable to PWRs (See SER Section 3.5.2.1.1)
Groups B2 and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-50)	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report
Group B1.1: high-strength low alloy bolts (3.5.1-51)	Cracking due to SCC; loss of material due to general corrosion	Bolting Integrity	No	Bolting Integrity Program	Consistent with GALL Report.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups B2 and B4: sliding support bearings and sliding support surfaces (3.5.1-52)	Loss of mechanical function due to corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.1.1)
Groups B1.1, B1.2, and B1.3: support members: welds, bolted connections, support anchorage to building structure (3.5.1-53)	Loss of material due to general and pitting corrosion	ISI (IWF)	No	ASME Section XI, Subsection IWF Program	Consistent with GALL Report.
Groups B1.1, B1.2, and B1.3: constant and variable load spring hangers, guides, stops (3.5.1-54)	Loss of mechanical function due to corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	ASME Section XI, Subsection IWF Program	Consistent with GALL Report.
Steel, galvanized steel, and aluminum support members; welds; bolted connections; support anchorage to building structure (3.5.1-55)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report.
Groups B1.1, B1.2, and B1.3: sliding surfaces (3.5.1-56)	Loss of mechanical function due to corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.1.1)
Groups B1.1, B1.2, and B1.3: vibration isolation elements (3.5.1-57)	Reduction or loss of isolation function, radiation hardening, temperature, humidity, and sustained vibratory loading	ISI (IWF)	No	Not applicable	Not applicable to CR-3 (See SER Section 3.5.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Galvanized steel and aluminum support members, welds, bolted connections, support anchorage to building structure exposed to air-indoor uncontrolled (3.5.1-58)	None	None	NA	None	Consistent with GALL Report.
Stainless steel support members, welds, bolted connections, support anchorage to building structure (3.5.1-59)	None	None	NA	None	Consistent with GALL Report.

The staff's review of the structures and component supports component groups followed any one of several approaches. One approach, documented in SER Section 3.5.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the structures and component supports is documented in SER Section 3.0.3.

3.5.2.1 Aging Management Review Results Consistent with the GALL Report

LRA Section 3.5.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the structures and component support:

- 10 CFR Part 50, Appendix J Program
- ASME Section XI, Subsection IWE Program
- ASME Section XI, Subsection IWL Program
- ASME Section XI, Subsection IWF Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Fuel Pool Rack Neutron Absorber Monitoring Program
- Fire Protection Program

- Inspection of Overhead Heavy Load and Light Load Handling Systems Program
- Masonry Wall Program
- One-Time Inspection Program
- Structures Monitoring Program
- Water Chemistry Program

LRA Tables 3.5.2-1 through 3.5.2-19 summarize AMRs for the containment, structures, and component supports components and indicate AMRs that claim to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMR's that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the containment, structures, and component supports systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. The staff's evaluation follows.

In multiple LRA tables, for AMR items with a reinforced concrete or elastomeric material, the applicant has identified the aging effect as "change in material properties," and referenced generic note A, which indicates these AMR items are consistent with the GALL Report. However, "change in material properties" is not an aging effect discussed in the GALL Report. In addition, several GALL Report aging effects were not addressed by the applicant. Therefore, by letter dated November 3, 2009, the staff issued RAIs 3.5.2.1-1 and 3.5.2.3-5, requesting the applicant detail which GALL Report aging effects are covered by "change in material properties," and how the aging effects will be adequately managed.

By letter dated December 3, 2009, the applicant responded and explained that for concrete, "change in material properties," includes the aging effects for increase in porosity and permeability due to aggressive chemical attack and leaching of calcium hydroxide; and loss of bond due to corrosion of embedded steel. The applicant further explained that this aging effect is managed by the Structures Monitoring Program and the ASME Section XI, Subsection IWL Program using periodic visual inspections. The applicant also stated that "change in material properties" in regards to elastomeric materials was equivalent to the GALL Report "loss of sealing" aging effect. This aging effect will be managed by the ASME Section XI, Subsection IWE and Appendix J programs for elastomers in the reactor building, and by the Structures Monitoring Program for all other in-scope elastomers.

The staff reviewed the applicant's responses and found them acceptable because the applicant explained that the aging effect "change in material properties" encompassed all of the applicable GALL Report aging effects. In addition, the aging management programs credited by the applicant match the programs recommended for these aging effects in the GALL Report. Therefore, the staff finds the RAI response acceptable as well as the applicant's use of generic note A for the corresponding AMR line items.

3.5.2.1.1 Aging Management Review Results Identified as Not Applicable

LRA Table 3.5.1, items 3.5.1-19, 3.5.1-20, and 3.5.1-21, and 3.5.1-49, discuss the applicant's determination that these line items are applicable only to BWRs. The staff verified that these line items do not apply because CR-3 is a PWR design. Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding AMR items 33.5.1-19, 3.5.1-20, and 3.5.1-21 are not applicable.

In LRA Table 3.5.1, items 3.5.1-52, 3.5.1-56, and 3.5.1-57, the applicant stated that the corresponding AMR items in the GALL Report are not applicable because CR-3 does not utilize susceptible components. The staff reviewed the LRA and FSAR and confirmed that the applicant's LRA does not have any corresponding AMR results that include in-scope supports or vibration isolation elements susceptible to those aging effects. A more detailed discussion of this review is included in SER Section 3.5.2.2.2.

3.5.2.1.2 Loss of Material and Form

In LRA Tables 3.5.2-3 and 3.5.2-7, for AMR items which reference LRA Table 3.5.1, item 3.5.1-48, the applicant credits the Structures Monitoring Program to manage loss of material and loss of form of earth in raw water (seawater) and outdoor air environments. The GALL Report recommends AMP XI.S7, "Inspection of Water-Control Structures" to manage this aging effect. The LRA AMR items cite generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited.

While reviewing the above AMR items, the staff found that under item III.A6-9 (T-22), the GALL Report specifies AERM as loss of material, loss of form/erosion, settlement, frost action, waves, currents, surface runoff, and seepage for earth in flowing and standing water. The AERMs related to erosion, settlement, frost action, waves, currents, surface runoff, and seepage for earth in flowing or standing water are not listed in LRA Table 3.5.2-7. Therefore, by letter dated November 3, 2009, the staff issued RAI 3.5.2.3-2, requesting justification for not addressing the AEMs related to erosion, settlement, frost action, waves, currents, surface runoff, and seepage. The staff further requested that the applicant describe how these aging effects will be managed by the Structures Monitoring Program so that the structures will perform the intended functions and be maintained consistent with the CLB during the period of extended operation.

In its response, dated December 3, 2009, the applicant stated LRA Table 3.5.2-7 provides the aging effects requiring management and does not list the aging mechanisms. The applicant noted that the applicable AMR line items are evaluated in LRA Table 3.5.1, item 3.5.1-48. The LRA Table 3.5.1, item 3.5.1-48, discussion states that CR-3 is consistent with the GALL Report for material, environment, and aging effect. In the RAI response the applicant confirmed that the specific aging mechanisms (erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, and seepage) are included in the license renewal AMR basis document

The staff reviewed the AMR results and noted that inspections related to these LRA line items are performed under the Structures Monitoring Program, which incorporates and is consistent with the recommendations of GALL Report AMP XI.S7. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.14. Since the applicant's Structures Monitoring Program includes, and is consistent with, the program elements of GALL Report AMP XI.S7, the staff finds these AMR results to be acceptable.

On the basis of its review, including applicant's response to RAI 3.5.2.3-2, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations described in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.3 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.5.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 Aging Management Review Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the structures and component supports and provides information concerning how it will manage aging effects in the following three areas:

(1) PWR containments:

- aging of inaccessible concrete areas
- cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting, and crevice corrosion

- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide

(2) safety-related and other structures and component supports:

- aging of structures not covered by the Structures Monitoring Program
- aging management of inaccessible areas
- reduction of strength and modulus of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- cracking due to SCC and loss of material due to pitting and crevice corrosion
- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

(3) Quality Assurance for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.5.2.2. The staff's review of the applicant's further evaluation follows.

3.5.2.2.1 PWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas as described below.

<u>Aging of Inaccessible Concrete Areas</u>. LRA Table 3.5.1, item 3.5.1-01, refers to LRA Section 3.5.2.2.1.1 which states that aging management of accessible concrete areas of the reactor building structure is accomplished through the ASME Section XI, Subsection IWL Program. The application further states that inaccessible below-grade portions of the structure are surrounded by other concrete structures and can not be monitored directly, but that examination of exposed portions of the structures is performed when uncovered. Additionally the Structures Monitoring Program ensures the groundwater is monitored for aggressiveness.

The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1 which states that corrosion of embedded steel could occur in inaccessible areas of concrete and steel containments. The existing program relies on the ASME Section XI, Subsection IWL Program to manage these aging effects. However, the GALL Report recommends further evaluation of plant-specific programs to manage aging effects for inaccessible areas if the environment is aggressive.

The GALL Report recommends examination of the exposed portions of the below-grade concrete, when excavated for any reason, and periodic monitoring of below-grade water chemistry, including consideration of potential seasonal variations. The staff confirmed that the Structures Monitoring Program will monitor the groundwater and will inspect the surrounding concrete whenever excavated. The SRP-LR also recommends the evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. This recommendation was not discussed in the application, so by letter dated November 3, 2009, RAI 3.5.2.2-1 was issued requesting the applicant to explain how this requirement was being met.

By letter dated December 3, 2009, the applicant explained that the requirement to evaluate the acceptability of inaccessible areas, when conditions exist in accessible areas that could indicate degradation in inaccessible areas, was part of the existing ASME Section XI, Subsection IWL Program and had been incorporated into the program manual which establishes and defines the requirements of the program.

The staff reviewed the applicant's response and found it acceptable because it explained that the existing CR-3 ASME Section XI, Subsection IWL Program includes a requirement to evaluate inaccessible areas whenever conditions in accessible areas indicate the possibility of degradation. The staff's concern described in RAI 3.5.2.2-1 was resolved.

On the basis of its review, including the response to RAI 3.5.2.2-1, the staff finds that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1. For those items that apply to LRA Section 3.5.2.2.1.1, the staff finds that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracks and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundations, if Not Covered by the Structures Monitoring Program. LRA Table 3.5.1, items 3.5.1-02 and 3.5.1-03, refer to LRA Section 3.5.2.2.1.2 which states that the aging effects caused by settlement are managed by the Structures Monitoring Program. The applicant also stated that the structures are founded on 1500 psi fill concrete placed over competent existing limerock. According to FSAR Section 2.5.7.2, "Reactor Building," the settlement analysis determined the upper limit for settlement was on the order of 0.875 inches. It was concluded that the estimated upper limit of total settlement, in all probability, would not be realized and that all but a very small fraction of settlement may be essentially elastic and would occur during construction. The total and differential settlements occurring after installation of equipment or instrumentation would, therefore, be expected to be a very small fraction of the estimated values. In LRA Section 3.5.2.2.1.2, the applicant stated that no cracking due to settlement has been observed. The applicant further stated that a dewatering system is not relied upon for control of settlement and CR-3 does not have a porous concrete subfoundation. The applicant has credited the Structures Monitoring Program for managing the aging effect of cracking.

The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which states that the cracks and distortion due to increased stress levels from settlement could occur in concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in all types of containments. The existing program relies on the Structures Monitoring Program to manage these aging effects. SRP-LR Section 3.5.2.2.1.2 also states that the GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

The CR-3 Structures Monitoring Program described in LRA Section B.2.30 is an existing program that is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.14. The staff noted that the applicant elected to use the Structural Monitoring Program to monitor the aging effects caused by settlement. AMR items related to this section credit the Structures Monitoring Program as well. However, the staff was unable to verify the procedure for monitoring settlement, or the inspection criteria for identifying cracks due to settlement under the Structures Monitoring Program. Therefore, by letter dated November 3, 2009, the staff issued RAI 3.5.2.2.1.2-1 requesting the applicant to provide the procedure for monitoring settlement under the Structures Monitoring Program and the criteria to identify the cracking and other aging effects due to increased stress levels from settlement in concrete and steel components of the CR-3 containment.

In its response dated December 3, 2009, the applicant stated that the implementing procedure monitors concrete cracking and seismic gaps. The applicant further stated that the performance standard for cracks is the absence of recent growth or other degradation mechanism. Another performance standard is that the gaps at buildings meet design requirements. In addition, the applicant noted that settlement has not manifested itself via cracked walls or cracked foundations in 33 years of operation, so cracking due to settlement is not a significant aging effect at CR-3. However, the visual inspections for concrete cracking, and any differential movement which would affect the gap design between buildings, will continue in the period of extended operation. The applicant further stated that CR-3 also performs inspections for concrete cracking in the Reactor Building (RB) in accordance with the ASME Section XI, Subsection IWL Program. CR-3's inspection identified minor cracking of accessible concrete howver, none of it was indicative of settlement. CR-3 also inspects steel surfaces of the RB according to ASME Section XI, Subsection IWE and looks for cracking, broken welds, bulging of the liner, and surface discontinuities which could be indications of increased stress levels from settlement.

On the basis of its review, the staff finds the applicant's Structures Monitoring Program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage cracks and distortion due to increased stress levels from settlement. Therefore, the staff finds that no further evaluation is required. The staff's concern described in RAI 3.5.2.2.1.2-1 is resolved.

On the basis of its review, the staff finds the applicant's assessment that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete is not applicable acceptable because CR-3 does not have a porous concrete subfoundation.

Based on the programs and analyses discussed above, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2. For those items that apply to LRA Section 3.5.2.2.1.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. LRA Table 3.5.1 item 3.5.1-04 refers to LRA Section 3.5.2.2.1.3 which states that the concrete degradation from elevated temperatures is not applicable because no RB pressure boundary concrete exceeds the temperature limits. The cooling system maintains the general area below an average temperature of 130 °F and the piping penetrations are maintained below 200 °F by insulation or the Penetration Cooling System (PCS).

The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3 which recommends further evaluation of plant-specific AMPs if any portion of the concrete containment components exceeds the specified temperature limits of 150 °F general and 200 °F local.

The staff reviewed Section 2.3.3.15 of the LRA and noted that the PCS is within the scope of license renewal, and has been screened in. The PCS is designed to maintain the concrete temperature adjacent to penetrations below 200 °F. The staff also reviewed Section 9.7.2 of the FSAR and noted that annunciation is provided for loss of air flow, high discharge temperature, and loss of fan operation. Since aging of the PCS will be managed during the period of extended operation, and any major failure of the system triggers an alarm, the staff finds there is assurance that the PCS will maintain the containment concrete below the limits during the period of extended operation. Therefore, the staff finds the applicant’s evaluation acceptable that this aging effect is not applicable because the containment concrete will remain below the allowable temperature limits.

Loss of Material Due to General, Pitting, and Crevice Corrosion. LRA Table 3.5.1, item 3.5.1-05, states that the item is applicable to BWRs only. LRA Table 3.5.1, item 3.5.1-05 corresponds to SRP-LR Table 3.5-1, item 5, which references SRP-LR Section 3.5.2.2.1.4. SRP-LR Section 3.5.2.2.1.4 states that loss of material due to general, pitting and crevice corrosion could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. SRP-LR Table 3.5-1, item 5 relates to BWR designs. The staff finds that the portions of SRP-LR Section 3.5.2.2.1.4 related to BWR designs and LRA Table 3.5.1, item 3.5.1-05, are not applicable to CR-3 because CR-3 is a PWR and the staff guidance in this SRP-LR section is only applicable to BWRs.

LRA Table 3.5.1, item 3.5.1-06, refers to LRA Section 3.5.2.2.1.4 which states that corrosion of the RB liner, liner anchors, and integral attachments is managed by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J Programs. The application further states that corrosion is not significant for inaccessible areas based on the following points:

(1) Concrete that met the requirements of ACI 318 was used and ACI 301-66 was used for the design and placement of the concrete.

(2) The liner is monitored for corrosion or degraded protective coatings by the ASME Section XI, Subsection IWE Program.

(3) The moisture barrier is monitored for aging effects by the ASME Section XI, Subsection IWE Program.

(4) Borated water spills and water ponding on the floor are not common, and are cleaned up promptly when identified. The RB floor provides for collection of water in a sump area that is maintained pumped-down.

The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4 which states that further evaluation is necessary if corrosion is significant. SRP-LR Table 3.5-1, item 6, corresponds to GALL Report items II.A1-11, II.A2-9, II.B3.2-9 which state that corrosion is not significant for inaccessible areas of steel containments (embedded containment steel shell or liner) if the following four conditions are satisfied:

(1) Concrete meeting the requirements of ACI 318 or 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.

(2) The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.

(3) The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Section XI, Subsection IWE requirements.

(4) Borated water spills and water ponding on the containment concrete floor are not common, and when detected are cleaned up in a timely manner.

The staff reviewed the construction codes and standards for CR-3 and found that the direction provided in ACI 301-66 and ACI 318, as well as in the CR-3 concrete specifications, meets or exceeds the recommendations in ACI 201.2R. Several RAIs were issued on this topic and further discussion of the acceptability of CR-3 concrete, as well as the resolution of the RAIs, is documented in SER Section 3.5.2.2.2. The staff also noted that the applicant inspects the moisture barrier in accordance with ASME Section XI, Subsection IWE, and promptly cleans any noted water spills. This claim was validated through an independent search of the applicant's operating experience. The applicant did not address SRP Criterion 2; therefore, by letter dated November 3, 2009, RAI 3.5.2.2.1.4-1 was issued requesting the applicant to explain if the Reactor Building concrete is monitored to ensure that it is free of penetrating cracks.

By letter dated December 3, 2009, the applicant explained that the concrete is monitored to ensure it is free of penetrating cracks. The ASME Section XI, Subsection IWL Program performs a visual examination of the accessible concrete for cracking on the RB dome cylinder walls, and foundation mat, while the Structures Monitoring Program performs a visual examination of the accessible concrete on the RB basement floor, which covers the floor liner plate. The applicant further explained that minor cracks (less than 0.04 inches) have been identified; however, no cracking has been identified on the RB basement floor, which covers the floor liner plate.

The staff reviewed the applicant's response and found it acceptable, because it explained that the concrete is monitored to ensure that it is free of penetrating cracks that may provide a path for water seepage to the surface of the containment liner. However, recent plant-specific operating experience related to containment concrete delamination resulted in containment through-wall vertical cracks, as well as portions of the liner plate being exposed to outdoor-air for extended periods of time. These conditions may have affected the liner plate and may provide a path for moisture to contact the liner plate during the period of extended operation.

Therefore, by letter dated November 8, 2010, RAI B.2.25-5 was issued requesting that the applicant explain how the ASME Section XI, Subsection IWE Program will monitor the condition of the containment liner plate to capture the effect of exposure to humidity and moisture during the time the liner was exposed to the elements. This issue is being tracked as part of Open Item (OI) **OI-3.5-1** and a detailed discussion of the RAI as well as the applicant's response can be found in the staff's evaluation of the applicant's ASME Section XI, Subsection IWE Program (See SER Section 3.0.3.1.13).

Based on the information provided, including the response to RAI 3.5.2.2.1.4-1, and pending closure of OI-3.5-1, the staff finds the applicant's evaluation of the aging effect "loss of material due to general, pitting and crevice corrosion" acceptable. The applicant has demonstrated that the SRP-LR conditions are satisfied, and no further evaluation is necessary. The staff's concern described in RAI 3.5.3.3.1.4-1 is resolved.

<u>Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature</u>. LRA Table 3.5.1, item 3.5.1-07, refers to LRA Section 3.5.2.2.1.5 which stated that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature is a TLAA for the CR-3 prestressed concrete containment.

The staff reviewed LRA Section 3.5.2.2.1.5 against the criteria in SRP-LR Section 3.5.2.2.1.5, which states that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

The CR-3 reactor building is a prestressed concrete containment. Therefore, loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature is a TLAA defined in 10 CFR 54.3. The applicant's TLAA evaluation in accordance with 10 CFR 54.21(c) is discussed in LRA Section 4.5. The staff's review of the applicant's evaluation of this TLAA is documented in the SER Section 4.5.

<u>Cumulative Fatigue Damage</u>. LRA Table 3.5.1, item 3.5.1-08 states that the item is applicable to BWRs only. LRA Table 3.5.1, item 3.5.1-08 relates to SRP-LR Table 3.5-1, item 8, which is only applicable to BWRs. The staff finds that LRA Table 3.5.1, item 3.5.1-08, is not applicable to CR-3 because CR-3 is a PWR.

LRA Table 3.5.1 item 3.5.1-09 refers to LRA Section 3.5.2.2.1.6 which states that fatigue analyses of suppression pool steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) are TLAAs as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.6 documents the staff's review of the applicant's evaluation of this TLAA.

<u>Cracking Due to Stress-Corrosion Cracking</u>. LRA Table 3.5.1, item 3.5.1-10, refers to LRA Section 3.5.2.2.1.7 which addresses stainless steel penetration sleeves and dissimilar metal welds exposed to air-indoor environment. The GALL Report recommends the ASME Section XI, Subsection IWE Program, 10 CFR Part 50, Appendix J Program, and additional appropriate examinations/evaluations for bellows assemblies and dissimilar metal welds to manage cracking due to stress corrosion cracking for this component group. The applicant stated that this item is not applicable because to be susceptible to SCC, stainless steel must be subjected to both a high temperature greater than 60 °C (greater than 140 °F) and an aggressive chemical environment, unless there is plant-specific operating experience showing SCC. The applicant

stated the penetration sleeves and the dissimilar metal weld components are in the air-indoor environment and not subject to an aggressive chemical environment.

LRA Section 3.5.2.2.1.7 states the exterior surface of the stainless steel fuel transfer tubes and associated components located in the RB refuel canal are included in this commodity group because the fuel transfer tubes are examined by the ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program. The applicant further stated that during refueling activities, the exterior surface of the stainless steel fuel transfer tubes and associated components are exposed to a treated water environment and that cracking due to SCC and use of the Water Chemistry Program is addressed in LRA Table 3.3.1, item 3.3.1-90, for the stainless steel fuel transfer tubes and associated components. The applicant stated the penetration bellows are installed outside the RB, so they are not part of the containment pressure boundary and are not within the scope of the license renewal.

The staff noted that stainless steel must be subject to both high temperatures (greater than 60 °C (140 °F)) and an aggressive chemical environment to be susceptible to SCC. NUREG-1833 states:

> In general, stress corrosion cracking very rarely occurs in austenitic stainless steels below 60 °C [140 °F]. Although stress corrosion cracking has been observed in stagnant, oxygenated borated water systems at lower temperatures than this 60 °C [140 °F] threshold, all of these instances have identified a significant presence of contaminants (halogens, specifically chlorides) in the failed components. With a harsh enough environment (significant contamination), stress corrosion cracking can occur in austenitic stainless steel at ambient temperature. However, these conditions are considered event driven, resulting from a breakdown of chemistry controls.

The staff noted that the applicant's site is located directly near the coastline, where large amounts of chlorides may be concentrated as aerosol particles in the air. By letter dated December 1, 2009, the staff issued RAI 3.5.2.2.1.7-1 requesting that the applicant provide additional information on why atmospheric chloride induced SCC does not need to be evaluated for penetration sleeves and dissimilar metal welds in an indoor air environment and why no AMP has been assigned to these components.

In its response dated December 30, 2009, the applicant stated that operating experience and technical documentation do not indicate an issue with stress corrosion cracking on indoor plant air for the penetration sleeves and dissimilar metal welds.

Based on its review, the staff finds the applicant's response to RAI 3.5.2.2.1.7-1 acceptable. The staff finds the applicant's claim that cracking due to SCC is not an applicable effect, requiring management for penetration sleeves and dissimilar metal welds, because the environment is not likely to contain aggressive chemicals and the applicant's operating history does not reveal prior indication of pitting, crevice corrosion, or cracking on the penetration sleeves. The staff's concern described in RAI 3.5.2.2.1.7-1 is resolved.

The staff also confirmed that the stainless steel fuel transfer tubes and associated components that are exposed to a treated water environment and subject to cracking due to SCC are addressed in LRA Table 3.3.1, item 3.3.1-90, and are managed by the applicant's Water Chemistry Program consistent with the recommendations of the GALL Report.

The applicant stated that for item 3.5.1-10, the applicability is limited to the components discussed above. The staff noted that a search of the applicant's FSAR confirmed that the penetration bellows are installed outside the reactor building and are not part of the containment pressure boundary and are, therefore, not within the scope of license renewal.

The staff concludes that the penetration sleeves addressed by the LRA and SRP-LR item are not within the scope of license renewal and, therefore, the management of the aging for these components, as required by 10 CFR 54.21(a)(3), is not applicable.

LRA Table 3.5.1, item 3.5.1-11, states that the item is applicable to BWRs only. LRA Table 3.5.1, item 3.5.1-11 relates to SRP-LR Table 3.5-1, item 11, which is only applicable to BWRs. The staff finds that LRA Table 3.5.1, item 3.5.1-11, is not applicable to CR-3 because CR-3 is a PWR.

Cracking Due to Cyclic Loading. LRA Table 3.5.1, item 3.5.1-12, refers to LRA Section 3.5.2.2.1.8 which addresses cracking in the CR-3 containment penetration sleeves, dissimilar metal welds, and fuel transfer tubes and cover plates due to cyclic loading. The applicant stated that cracking due to cyclic loading is adequately managed by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs for the penetration sleeves, dissimilar metal welds, and fuel transfer tubes and cover plates in the RB. The applicant further stated that the penetration bellows at CR-3 are installed outside the RB and are not part of the containment pressure boundary; therefore, they are not within the scope of license renewal. The applicant also stated that no operating experience has been found for aging effect of fine cracking of these components and CR-3 does not expect fine cracking of the penetration sleeves, dissimilar metal welds, fuel transfer tubes, and cover plates to occur.

The staff reviewed LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8, which states that cracking due to cyclic loading of the stainless steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur in PWR containments. The existing program relies on ASME Section XI, Subsection IWE Program and 10 CFR Part 50, Appendix J Program to manage this aging effect. However, VT-3 visual inspection may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

The staff's review indicates that for the CR-3 containment, the number of thermal cycles is relatively low for containment penetrations, and design basis calculations implicitly consider cyclic stress in the selection of the allowable stress limit. In addition, as described in CR-3 LRA Section 4.6.1, the fuel transfer tube expansion bellows have been designed to withstand a total of 5,000 cycles compared to 87 cycles that the bellows are expected to be subjected to over its 60-year life. Furthermore, the bellows are located outside the RB and not part of the containment pressure boundary. Therefore, because the design basis calculations considered cyclic loading, and the expected number of cycles is much lower than the design cycles, it is unlikely that the component will experience cracking. Nonetheless, the staff finds the applicant's assessment that ASME Section, Subsection IWE Program inspections and containment leak rate testing under the 10 CFR Part 50, Appendix J Program will be adequate to detect cracking due to cyclic loading during the extended period of operation, acceptable, and no supplemental inspections are necessary.

LRA Table 3.5.1, item 3.5.1-13, states that the item is applicable to BWRs only. LRA Table 3.5.1, item 3.5.1-1 relates to SRP-LR Table 3.5-1, item 13, which is only applicable to

BWRs. The staff finds that LRA Table 3.5.1, item 3.5.1-13, is not applicable to CR-3 because CR-3 is a PWR.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.8 criteria. For those items that apply to LRA Section 3.5.2.2.1.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw. LRA Table 3.5.1, item 3.5.1-14, refers to LRA Section 3.5.2.2.1.9 which states that loss of material due to freeze-thaw is not an applicable effect because CR-3 is located in a negligible weathering region and past examinations of accessible concrete have not identified any aging effects due to freeze-thaw.

The staff reviewed LRA Section 3.5.2.2.1.9 against the criteria in SRP-LR Section 3.5.2.2.1.9 which states that the GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions.

Since CR-3 is located in a negligible weathering region according to ASTM C33, and CR-3 has no past experience with freeze-thaw degradation, the staff agrees that the aging effect is not applicable and no further evaluation is required.

Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide. LRA Table 3.5.1, item 3.5.1-15, refers to LRA Section 3.5.2.2.1.10 which states that cracking due to expansion and reaction with aggregate is not an applicable aging effect because the aggregates were tested in accordance with ASTM C227 and the concrete was constructed to ACI 301-66 specifications, which provides guidance similar to ACI 201.2R. However, due to minor indications of leaching in below-grade concrete in the RB tendon access gallery, an equivalent aging effect of change in material properties has been assigned, and will be managed by the ASME Section XI, Subsection IWL Program.

The staff reviewed LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10 which states that the existing program relies on ASME Section XI, Subsection IWL Program to manage this aging effect. The SRP-LR further states that the GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff reviewed the FSAR and was unable to verify that ASTM C227 had been used during construction to test the aggregates for reactivity. By letter dated November 3, 2009, RAI 3.5.2.2.2.2-1 was issued requesting the applicant to explain how the standards listed in the FSAR meet the recommendations of the ASTM standards discussed in the GALL Report. The staff also reviewed the applicant's claim that the guidance in ACI 301-66 aligns with ACI 201.2R-77. After reviewing the information provided, including the response to the RAI, the staff concluded that the concrete was constructed in accordance with ACI recommendations. A detailed discussion of the staff's review of the equivalence of CR-3 concrete to the ACI 201.2R-77 recommendations, including the resolution of RAI 3.5.2.2.2.2-1, is documented in SER Sections 3.5.2.2.2.

On the basis of its review the staff determines that further evaluation of the above aging effects is not necessary because, CR-3 is using the GALL Report recommended AMP for accessible concrete, and the concrete was constructed in accordance with the recommendations in ACI 201.2R. The staff's concern described in RAI 3.5.2.2.2-1 is resolved.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addresses several areas as described below.

Aging of Structures Not Covered by the Structures Monitoring Program. LRA Table 3.5.1, items 3.5.1-23, 3.5.1-24, 3.5.1-25, 3.5.1-26, 3.5.1-27, 3.5.1-28, 3.5.1-29, and 3.5.1-30, refer to LRA Section 3.5.2.2.2.1 which states that the Structures Monitoring Program is used to manage the aging effects due to corrosion of embedded steel, aggressive chemical attack, settlement for concrete, and loss of material for steel elements. The remaining aging effects which are not covered by the Structures Monitoring Program are discussed in further detail below.

The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1 which states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the Structures Monitoring Program, including: (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups (as defined in Section III.A of the GALL Report) 1-5, 7, and 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, and 9 structures; (3) loss of material due to corrosion for Groups 1-5, 7, and 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures.

In addition, the SRP-LR states that lock-up due to wear may occur for Lubrite® radial beam seats in BWR drywells, RPV support shoes for PWRs with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing CR-3 program relies on the Structures Monitoring Program or ASME Section XI, Subsection IWF Program, to manage this aging effect. The GALL Report recommends further evaluation only for structure-aging effect combinations not within the ASME Section XI, Subsection IWF Program or Structures Monitoring Programs.

The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.14. Additional reviews of specific aging effects are discussed below:

(1) Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, and 9 Structures

The applicant stated in the LRA that cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for accessible concrete areas of Groups 1-5, 7, and 9 structures is managed by the Structures Monitoring Program.

The staff confirmed that Groups 1-5, 7, and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(2) Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, and 9 Structures

The applicant stated in the LRA that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for accessible concrete areas of Groups 1-5, 7, and 9 structures is managed by the Structures Monitoring Program.

The staff confirmed that Groups 1-5, 7 and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(3) Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

The applicant stated in the LRA that loss of material due to corrosion for Groups 1-5, 7, and 8 structures is managed by the Structures Monitoring Program.

The staff confirmed that Groups 1-5, 7, and 8 structures subject to this AMR are in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(4) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 Structures

The applicant stated in the LRA that loss of material (spalling, scaling) and cracking due to freeze-thaw for Group 1-3, 5, and 7-9 structures is not applicable because CR-3 is located in a negligible weathering region per ASTM C33.

Since CR-3 is located in a negligible weathering region according to ASTM C33, and CR-3 has no past experience with freeze-thaw degradation, the staff agrees that the aging effect is not applicable and no further evaluation is required.

(5) Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

The applicant stated in the LRA that cracking due to expansion and reaction with aggregates for accessible concrete areas of Groups 1-5, and 7-9 structures is not applicable because the aggregates were tested in accordance with ASTM C227 and the concrete was constructed to ACI 301-66 specifications, which provides guidance similar to ACI 201.2R.

The GALL Report item T-03 recommends the Structures Monitoring Program to manage cracking due to expansion and reaction with aggregates in accessible concrete areas regardless of how the concrete was constructed. By letter dated November 3, 2009, the staff issued RAI 3.5.2.2.2.1-2, asking the applicant to explain why its Structures Monitoring Program does not monitor for this aging effect in accessible concrete.

By letter dated December 3, 2009, the applicant explained that the Structures Monitoring Program examines accessible concrete for the aging effect of cracking regardless of the aging mechanism. Because accessible concrete will be inspected for cracking, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met; therefore, no further evaluation is required. The staff’s concern described in RAI 3.5.2.2.2.1-2 is resolved.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

The staff confirmed that Groups 1-3 and 5-9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(7) Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3 and 5-9 Structures

The applicant stated in the LRA that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations for Groups 1-3 and 5-9 Structures is not applicable because CR-3 does not have a porous subfoundation and a dewatering system is not relied upon.

The staff agrees this aging affect is not applicable because CR-3 has no porous concrete subfoundations.

(8) Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

The staff reviewed lockup in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1. SRP-LR Section 3.5.2.2.2.1 states that lock-up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ASME Section XI, Subsection IWF Program or Structures Monitoring Program.

LRA Section 3.5.2.2.2.1 states that lock up due to wear is not applicable because CR-3 does not use Lubrite® in these applications. However, the applicant has included lockup as an aging effect in AMR Table 3.5.2-1 with plant-specific note 510. According to plant-specific note 510, the same aging effect used in the GALL Report, item III.A4-6, for Lubrite® plates, lock-up is assigned to Fluorogold sliding bearing plates used on structural steel. In addition, CR-3 determined that a change in material properties due to radiation is an applicable aging effect. The Structures Monitoring Program is credited for inspecting the sliding bearing plates which includes the Fluorogold plates. According to LRA AMP B.2.30, an enhancement to the Structures Monitoring Program element “Parameters Monitored or Inspected” will be implemented prior to the period of extended operation for inspection of the Fluorogold sliding bearing plates used in a structural steel platform application located in the RB on an established frequency. According to item 11 of Commitment No. 20, the applicant has committed to implement this enhancement prior to the period of extended operation.

LRA Section 3.5.2.2.2.1 does not present the information related to lock-up of the sliding bearing plates which includes the Fluorogold plates. However, plates are included in LRA Table 3.5.2-1, with LRA plant-specific note 510. By letter dated November 3, 2009, staff issued RAI 3.5.2.2.2.1-1 requesting the applicant to:

(1) Discuss how the aging management of Lubrite® plates is applicable to Fluorogold plates and any other sliding bearing plates used in CR-3. Also describe what inspection criteria are (or will be) followed for identification of change of material properties of these plates due to radiation. Indicate

if any other aging effect is applicable to the sliding bearing plates including the Fluorogold plates.

(2) Describe how the criteria of the SRP-LR Section 3.5.2.2.2.1 on lock-up due to wear have been met, and no further evaluation is required.

(3) Discuss accumulation of debris which may resist sliding.

In its response, by letter dated December 3, 2009, the applicant stated that Fluorogold and Lubrite® are trade names for reduced friction sliding surface bearing plates used with pipe supports or other applications, and used with support elements that experience thermal growth. At CR-3, Fluorogold sliding bearing plates were used in applications involving pipe supports and structural steel. CR-3 manages the aging effects of pipe supports by the ASME Section XI, Subsection IWF Program. Furthermore, the aging effect of loss of mechanical function was selected for Fluorogold since it was used for the same application as Lubrite® material, and moreover, loss of mechanical function is applicable to any material type for sliding bearing plates. Further explanation is provided by the applicant in the plant-specific notes 511 and 549. The applicant also manages the aging effect of change of material properties for pipe supports in the RB and the Auxiliary Building (AB) due to radiation based on vendor literature. In addition, the applicant manages the aging effect of lock-up for Fluorogold plates with the Structures Monitoring Program. Flourogold is a material similar to Lubrite® and is used in similar applications. In an application in the RB with possibility of high radiation exposure, the applicant manages the aging effect of change in material properties for structural steel based on recommendations contained in vendor literature. The applicant has provided an explanation in the plant-specific notes 510 and 551 for Fluorogold sliding plates in the cable bridge.

The applicant further stated that change in material properties due to exposure to radiation could affect the sliding function of the Fluorogold which can potentially damage the steel members. The Fluorogold bearing surfaces are inaccessible, except for the edges. The applicant's Structures Monitoring Program performs visual inspections for restricted movements and damaged steel members or connections to identify deformations, tears, cracks, or broken welds. The applicant uses the ASME Section XI, Subsection IWF Program, to perform examinations of supports including structural degradation of building structure supports; loosened, bent, cracked or damaged parts; cracked or degraded welds; obstructions to pipe movement, misalignment and improper clearances; evidence of overload; scoring or roughness on sliding surfaces; and foreign material accumulation.

In response to item 2 of the RAI 3.5.2.2.2.1-1 the applicant explained that the SRP-LR, Section 3.5.2.2.2.1, was only applicable to Lubrite® material, as stated in LRA Table 3.5.1, item 3.5.1-30. Since Fluorogold was used, no further evaluation was provided in LRA Section 3.5.2.2.2.1. LRA Section 3.5.2.2.2.1 did state, "Lock up due to wear for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces is not applicable because CR-3 does not utilize Lubrite® in these applications." The CR-3 methodology associated the Fluorogold sliding bearing plates with the applicable commodities for either "Steel Components: All Structural Steel" and/or "Supports for ASME Class 1, 2, 3 Piping & Components" in LRA Tables 3.5.2-1, 3.5.2-2, 3.5.2-5, and 3.5.2-14, and provided an explanation in plant-specific notes 510, 511, 549, and 551.

In response to item 3 of RAI 3.5.2.2.2.1-1, the applicant confirmed that they considered accumulation of debris which may resist sliding and also included the other aging effect/mechanism of loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads.

Based on the applicant's response, the staff concludes that the criteria of the SRP-LR Section 3.5.2.2.2.1 on lock-up due to wear have been met, and no further evaluation is required. The staff's concern described in RAI 3.5.2.2.2.1-1 is resolved.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs and analyses discussed above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those items that apply to LRA Section 3.5.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Management of Inaccessible Areas. The staff reviewed LRA Section 3.5.2.2.2.2 against the following criteria in SRP-LR Section 3.5.2.2.2.2.

(1) LRA Table 3.5.1, item 3.5.1-26, refers to LRA Section 3.5.2.2.2.2.1 which states that loss of material and cracking due to freeze-thaw is not an applicable effect because CR-3 is located in a negligible weathering region and past examinations of accessible concrete have not identified any aging effects due to freeze-thaw.

The staff reviewed LRA Section 3.5.2.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.2.1 which states that loss of material (spalling and scaling) and cracking due to freeze-thaw may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these groups of structures for plants located in moderate to severe weather conditions.

Since CR-3 is located in a negligible weathering region according to ASTM C33, and CR-3 has no past experience with freeze-thaw degradation, the staff agrees that the aging effect is not applicable and no further evaluation is required.

(2) LRA Table 3.5.1, item 3.5.1-27, refers to LRA Section 3.5.2.2.2.2.2 which states that the aging effect is not applicable because the aggregates were tested in accordance with ASTM C227 and the concrete was constructed to ACI 301-66 specifications, which provides guidance similar to ACI 201.2R.

The staff reviewed LRA Section 3.5.2.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2(2) which states that cracking due to expansion and reaction with aggregates may occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these groups of structures, if concrete was not constructed in accordance with ACI 201.2R-77 recommendations.

SRP-LR Table 3.5-1 ID 27 which corresponds to LRA Table 3.5.1, item 3.5.1-27, notes a related item of T-03. The GALL Report for unique items (e.g., III.A1-2), in regard to related item T-03, states that ASTM C-295 or ASTM C-227 can be used to demonstrate that aggregates are non-reactive. If non-reactive aggregates are used, aging management is not necessary. The applicant stated that the aggregate at CR-3 was tested in accordance with ASTM C-227 and found to be non-reactive. The staff reviewed the FSAR and was unable to verify that ASTM C-227 had been used during construction to test the aggregates for reactivity. By letter dated November 3, 2009, RAI 3.5.2.2.2.2-1 was issued requesting the applicant to explain how the standards listed in the FSAR meet the requirements of the ASTM standards discussed in the GALL Report.

By letter dated December 3, 2009, the applicant stated that the CR-3 FSAR does not specifically list ASTM C227 or C295; however, fine and coarse aggregates at CR-3 were tested with each brand of cement for possible alkali reactions in accordance with ASTM C227. The applicant further explained that this information was provided to the NRC in a report submitted on December 10, 1976.

The staff reviewed the applicant's response, and verified that ASTM C227 was used to test the aggregates for reactivity. Since the recommended tests were used, the applicant's response is acceptable and the staff's concern described in RAI 3.5.2.2.2.2-1 is resolved.

On the basis of its review, including the response to RAI 3.5.2.2.2.2-1, the staff finds that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.2. Since the aggregates in the CR-3 concrete are non-reactive, the staff finds that no additional AMP is required to manage this aging effect.

(3) LRA Table 3.5.1, items 3.5.1-28 and 3.5.1-29, refer to LRA Section 3.5.2.2.2.2.3 which states that a dewatering system is not relied on for settlement control and the Structures Monitoring Program examines concrete for cracking due to settlement. The LRA further states that no cracking due to settlement is expected or has been observed. No porous subfoundations exist at CR-3.

The staff reviewed LRA Section 3.5.2.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.2.3 which states that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The existing program relies on structures monitoring to manage these aging effects. Some plants may rely on dewatering systems to lower site groundwater level. If the plant's CLB credits a dewatering system, the GALL Report recommends verification of the system's continued functionality during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

On the basis of its review, the staff determines that further evaluation of the above aging effects is not necessary because CR-3 does not use a dewatering system, and there are no porous subfoundations on the site. In addition, the cracking due to settlement is monitored under the Structures Monitoring Program.

(4) LRA Table 3.5.1, item 3.5.1-31, refers to LRA Section 3.5.2.2.2.2.4 which states that the Structures Monitoring Program will monitor groundwater on a periodic basis and examine the exposed portions of the below-grade concrete when excavated for any

reason. The LRA provides groundwater chemistry values for February, 2007 which meet the GALL Report limits for non-aggressive groundwater chemistry.

The staff reviewed LRA Section 3.5.2.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.2(4) which states that increase in porosity and permeability, cracking, and loss of material (spalling and scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling and scaling) due to corrosion of embedded steel may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas of these groups of structures in aggressive environments.

GALL Report Table 5, item 31, corresponds to LRA Table 3.5.1, item 3.5.1-31. GALL Report Table 5, item 31, refers to GALL Report generic item T-05 which recommends periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries, as well as examination of exposed portions of below-grade concrete whenever excavated. The staff noted that the applicant's Structures Monitoring Program will be enhanced to require examination of exposed portions of below-grade concrete and to perform groundwater monitoring. Additionally, the Structures Monitoring Program inspects for this aging effect on accessible concrete areas. While reviewing the plant-specific notes, the staff found that the seawater at CR-3 is aggressive. By letter dated November 3, 2009, the staff issued RAI 3.5.2.2.2.2-3 requesting the applicant to explain if the aggressive seawater would have any affect on Groups 1-3, 5 and 7-9 structures.

By letter dated December 3, 2009, the applicant stated that the Groups 1-3, 5 and 7–9 structures will only be exposed to groundwater, which has been shown to be non-aggressive. The aggressive seawater only contacts structures in the commodity group "concrete: submerged," which applies only to concrete which is accessible for visual inspection by using divers or by draining portions of the structure, it does not apply to inaccessible concrete. The applicant also stated that the Structures Monitoring Program will continue to monitor groundwater for aggressiveness and will continue to examine exposed portions of below-grade concrete when excavated for any reason.

The staff reviewed the applicant's response and found it acceptable because the inaccessible structures in question are only exposed to a groundwater environment, which is not aggressive. The Structures Monitoring Program will continue to monitor the groundwater and will inspect exposed portions of the structures. Therefore, the applicant's response is acceptable and the issue in RAI 3.5.2.2.2.2-3 related to Groups 1-3, 5, and 7-9 structures is resolved

On the basis of its review, including the response to RAI 3.5.2.2.2.2-3, the staff finds that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2.4. There is reasonable assurance that the aging effect increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures will be adequately managed during the period of extended operation.

(5) LRA Table 3.5.1, item 3.5.1-32, refers to LRA Section 3.5.2.2.2.2.5 which states that CR-3 concrete was constructed in accordance with ACI 301-66, which provides guidance similar to the recommendations in ACI 201.2R-77. However, due to minor

indications of leaching in below-grade concrete in the RB tendon access gallery, all below-grade concrete within the scope of license renewal will be examined whenever excavated under the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.2(5) which states that increases in porosity and permeability, and loss of strength due to leaching of calcium hydroxide may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of Groups 1-3, 5 and 7-9 structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77. The staff is not clear how ACI 301-66 meets the intent of ACI 201.2R-77. By letter dated November 3, 2009, the staff issued RAI 3.5.2.2.2.2-2 requesting the applicant to compare the two standards and explain how ACI 301-66 meets the intent of ACI 201.2R-77.

By letter dated December 3, 2009, the applicant explained that while general recommendations for concrete design were provided in ACI 301, supplemental requirements for CR-3 concrete were provided in the CR-3 concrete specifications. In the response, the concrete specifications were summarized as follows: the air content was specified as 3-6 percent for the majority of the structures and as 1.5 percent for the EFW Pump Building; the water-cement (w/c) ratio ranged from 0.38 to 0.53 depending on the structure and the required mix strength; and the materials standards matched ASTM standards recommended by ACI 201.2R. The response then went on to compare the CR-3 concrete specifications to the recommendations in ACI 201.2R.

The applicant stated that ACI 201.2R states that a value of 0.40 should be the maximum w/c ratio for concrete exposed to seawater. ACI 201.2R further recommends 3 inches minimum concrete cover on reinforcing steel for concrete near the waterline or in marine environments and provides an allowance to increase the w/c ratio to 0.45 if the concrete cover is increased by ½ inch. For structures above the sea and spray range, the w/c ratio should not exceed 0.50. The applicant explained that several structures exceed the maximum w/c ratio (0.53 versus 0.40) for concrete exposed to seawater. However, these structures have a concrete cover over the reinforcing steel of 3 or 4 inches, which meets or exceeds the ACI 201.2R recommendations. In addition, the structures in seawater are visually inspected under the Structures Monitoring Program. The applicant explained that these structures are considered accessible with divers or by draining the areas. For structures not exposed to seawater, the maximum w/c ratio of 0.53 was only slightly above the maximum ACI value of 0.50. The applicant stated that this minimal difference was negligible.

The applicant stated that ACI 201.2R recommends an average air content of 3-6 percent for structures in a moderate weathering region. CR-3 concrete specifications require air content of 3-6 percent except for the EFW Pump building which has an air content of approximately 1.5 percent. The applicant further explained that this lower value is considered acceptable because the 3-6 percent recommendation applies to moderate weathering regions, while CR-3 is located in a negligible weathering region. ACI 201.2 does not specify an air content value for negligible weathering regions.

The staff reviewed the applicant’s response and found it acceptable, because the CR-3 concrete specifications align closely with the recommendations in ACI 201.2R. For Groups 1-3, 5, and 7-9 structures (i.e., structures not exposed to seawater), the maximum w/c ratio of 0.53 exceeds the recommended value of 0.50 by a negligible amount. Although structures exposed to seawater do exceed the recommended value of 0.40, all of these structures are available for inspection. Inspection of these structures on a five-year frequency in accordance with ACI 349.3R, ensures any degradation will be captured in a timely fashion. In addition, the low air content in the EFW Pump Building is acceptable because air content is an indicator of a concrete's resistance to freezing and thawing; the higher the air content, the higher the resistance. Since CR-3 concrete is located in a negligible weathering region, degradation due to freeze-thaw is not an issue (See SER Section 3.5.2.2.2.2.1); therefore, the low air content is not an issue. Also, the CR-3 material specifications conform to the same ASTM standards discussed in ACI 201.2R. In addition to the fact that the CR-3 specifications align closely with the ACI recommendations, CR-3 will continue to inspect accessible areas of concrete and has enhanced the Structures Monitoring Program to examine any below-grade concrete within the scope of license renewal when excavated for any reason. The staff's concern described in RAI 3.5.2.2.2.2-2 is resolved.

On the basis of its review, including the response to RAI 3.5.2.2.2.2-2, the staff finds that the applicant has adequately addressed the criteria of SRP-LR Section 3.5.2.2.2.2.5. Since the CR-3 concrete specifications align closely with ACI 201.2R recommendations, there is reasonable assurance that the aging effect increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures will be adequately managed during the period of extended operation.

Based on the programs and analyses discussed above, including the RAI responses, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2. For those items that apply to LRA Section 3.5.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature</u>. LRA Table 3.5.1, item 3.5.1-33 refers to LRA Section 3.5.2.2.2.3 which states that concrete degradation from elevated temperatures is not applicable, because neither the RB non-pressure boundary concrete, nor the concrete structures outside the RB exceed the specified temperature limits. The LRA further states that the RB average temperature is maintained below 130 °F (54 °C) and the areas between the primary shield wall and the reactor vessel is maintained at a temperature below 200 °F (93 °C). The application also states that the local area inside the "D" Ring above the 119 ft.-elevation near the top of the pressurizer is subject to a temperature of 164.3 °F (73.5 °C) but the area is open to the general containment environment.

The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3 which states that reduction of strength and modulus of concrete due to elevated temperatures may occur in PWR and BWR Groups 1-5 concrete structures. For concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A to ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. Temperatures shall not exceed 150 °F (65 °C) except for local areas allowed to have temperatures not to exceed 200 °F (93 °C).

The staff noted that the area near the top of the pressurizer is considered a local area. Therefore, the staff finds the applicant's evaluation acceptable, that this aging effect is not applicable on the basis that CR-3 Group 1-5 concrete does not experience temperatures above the GALL Report recommended limits.

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the following criteria in SRP-LR Section 3.5.2.2.2.4:

(1) LRA Table 3.5.1, item 3.5.1-34, refers to LRA Section 3.5.2.2.2.4.1 which states that the Structures Monitoring Program will monitor groundwater on a periodic basis and examine the exposed portions of the below-grade concrete when excavated for any reason. The LRA provides groundwater chemistry values for February 2007, which meet the GALL Report limits for non-aggressive groundwater chemistry.

The staff reviewed LRA Section 3.5.2.2.2.4.1 against the criteria in SRP-LR Section 3.5.2.2.2.4.1 which states that increased porosity and permeability, cracking, loss of material (spalling and scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling and scaling)/corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive. While reviewing the plant-specific notes, the staff found that the seawater at CR-3 is aggressive. By letter dated November 3, 2009, the staff issued RAI 3.5.2.2.2.2-3 requesting the applicant to explain if the aggressive seawater would have any affect on Group 6 structures.

By letter dated December 3, 2009, the applicant stated that the inaccessible portions of the Group 6 structures will only be exposed to groundwater, which has been shown to be non-aggressive. The aggressive seawater only contacts structures in the commodity group "concrete: submerged," which applies only to concrete which is accessible for visual inspection; it does not apply to inaccessible concrete. The applicant explained that the Structures Monitoring Program is adequate to manage aging of concrete submerged in aggressive seawater because of the following:

- The concrete is accessible for visual inspection by divers or by draining portions of the structure;
- The periodic inspection frequency is 5 years as specified in ACI 349.3R;
- A reassessment of the inspection frequency based on the results of the inspection is required;
- Plant operating experience has identified no unacceptable concrete aging effects due to the aggressive seawater environment.

The staff reviewed the applicant's response and found it acceptable because the inaccessible structures in question are only exposed to a groundwater environment, which is not aggressive based on recent groundwater samples. The Structures Monitoring Program will continue to monitor the groundwater for aggressiveness and will inspect exposed portions of the below-grade structures whenever excavated. The Structures Monitoring Program will continue to inspect accessible portions (i.e., those portions of the structures which are exposed to aggressive seawater) of the Group 6 structures on a 5-year frequency.

On the basis of its review, the staff finds that there is reasonable assurance that the aging effect, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Group 6 structures will be adequately managed during the period of extended operation.

(2) LRA Table 3.5.1, item 3.5.1-35, refers to LRA Section 3.5.2.2.2.4.2 which states that loss of material and cracking due to freeze-thaw is not an applicable effect because CR-3 is located in a negligible weathering region and past examinations of accessible concrete have not identified any aging effects due to freeze-thaw.

The staff reviewed LRA Section 3.5.2.2.2.4.2 against the criteria in SRP-LR Section 3.5.2.2.2.4.2 which states that loss of material (spalling and scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these structures for plants located in moderate to severe weathering conditions.

Since CR-3 is located in a negligible weathering region according to ASTM C33, and CR-3 has no past experience with freeze-thaw degradation, the staff agrees that the aging effect is not applicable and no further evaluation is required.

(3) LRA Table 3.5.1, items 3.5.1-36 and 3.5.1-37, refer to LRA Section 3.5.2.2.2.4.3 addresses cracking due to expansion and reaction with aggregates, increased porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Group 6 structures, stating that the aging effect is not applicable because the aggregates were tested in accordance with ASTM C227 and the concrete was constructed to ACI 301-66 specifications, which provide guidance similar to ACI 201.2R. The LRA further states that due to minor indications of leaching in below-grade concrete in the RB tendon access gallery, the aging effect will be managed under the Structures Monitoring Program

The staff reviewed LRA Section 3.5.2.2.2.4.3 against the criteria in SRP-LR Section 3.5.2.2.2.4.3 which states that the GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R. The staff's review for cracking due to expansion and reaction with aggregates for inaccessible concrete elements, including the review of the applicant's concrete, is documented in SER Section 3.5.2.2.2.2.2. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.14.

Since the applicant's aggregate was tested in accordance with the GALL Report recommended ASTM standards, as discussed in SER Section 3.5.2.2.2.2.2, and the concrete specifications meet the recommendations of ACI 201.2R, as discussed in SER Section 3.5.2.2.2.2.5, the staff finds that further evaluation is not necessary. The criteria of SRP-LR Section 3.5.2.2.2.4.3 have been met for cracking due to expansion and reaction with aggregates.

The staff's review for an increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide for inaccessible concrete elements is documented in SER Section 3.5.2.2.2.2.5. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.14.

Since the applicant's concrete was constructed in accordance with ACI 201.2R, as discussed in SER Section 3.5.2.2.2.2.5, the staff finds that further evaluation is not necessary, and the criteria of SRP-LR Section 3.5.2.2.2.4.3 have been met for an increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide.

Based on the programs discussed above, including RAI responses, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4. For those items that apply to LRA Section 3.5.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking Due to SCC and Loss of Material Due to Pitting and Crevice Corrosion. LRA Table 3.5.1, item 3.5.1-38, refers to LRA Section 3.5.2.2.2.5 which states that cracking due to SCC and loss of material due to pitting and crevice corrosion of stainless steel tank liners is not applicable to CR-3 because CR-3 does not have tanks with stainless steel liners. The LRA further states that aging management of tanks is addressed with the mechanical system in which the tanks are located.

The staff reviewed LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5 which states cracking due to SCC and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

The staff reviewed the LRA and FSAR and confirmed that there are no AMR results for stainless steel tank liners. The staff also confirmed that aging management of tanks is addressed with the mechanical system to which the tanks belong. Based on its review of the LRA and FSAR, the staff confirmed that the applicant's plant does not have any in-scope stainless steel tank liners; therefore this aging effect is not applicable.

Aging of Supports Not Covered by the Structures Monitoring Program. LRA Table 3.5.1, items 3.5.1-39, 3.5.1-40, and 3.5.1-41, refer to LRA Section 3.5.2.2.2.6 which states that the Structures Monitoring Program is used to manage loss of material due to general and pitting corrosion for Groups B2-B5 supports for CR-3 structures within the scope of license renewal. Also LRA Table 3.5.1, item 3.5.1-39, states that loss of material is managed by the Structures Monitoring Program. In addition, LRA Section 3.5.2.2.2.6 states that the Structures Monitoring Program is used to manage reduction in concrete anchor capacity due to degradation of the surrounding concrete, for groups B1-B5 supports for CR-3 structures within the scope of license renewal. Furthermore, LRA Section 3.5.2.2.2.6 states that reduction or loss of isolation function due to degradation of vibration isolation elements for Group B4 supports is applicable only in the control complex, Intermediate Building, Machine Shop, and Turbine Building for ventilation equipment. LRA Table 3.5.1, tem 3.5.1-41, states that reduction or loss of isolation function for non-metallic (elastomeric) vibration isolator for the ventilation system is managed by the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6, which recommends further evaluation for: (1) loss of material due to general and pitting corrosion for groups B2 through B5 supports, (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1 through B5 supports, and (3) reduction or loss of isolation function due to degradation of vibration isolation elements for Group B4 supports if they are not covered by the Structures Monitoring Program.

Because loss of material due to general and pitting corrosion for groups B2-B5 supports is being covered by the Structures Monitoring Program, the staff concludes that the criteria of SRP-LR Section 3.5.2.2.2.6(1) have been met, and no further evaluation is required. Similarly, because reduction in concrete anchor capacity due to degradation of the surrounding concrete for groups B1-B5 supports is being covered by the Structures Monitoring Program, the staff concludes that the criteria of SRP-LR Section 3.5.2.2.2.6(2) have been met, and no further evaluation is required. Finally, because the reduction or loss of isolation function due to degradation of vibration isolation elements for Group B4 supports is being covered by the Structures Monitoring Program, the staff concludes that the criteria of SRP-LR Section 3.5.2.2.2.6(3) have been met, and no further evaluation is required. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.14.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.6 criteria. For those items that apply to LRA Section 3.5.2.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cumulative Fatigue Damage Due to Cyclic Loading. LRA Table 3.5.1, item 3.5.1-42, refers to LRA Section 3.5.2.2.2.7 which states that fatigue evaluation of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a CLB fatigue analysis exists. The applicant also stated that since there are no fatigue analyses in the CLB applicable to component supports, cumulative fatigue damage of component supports is not a TLAA as defined in 10 CFR 54.3.

The staff reviewed the applicant's FSAR and did not identify analyses associated with fatigue of component support members, anchor bolts and welds for Group B1.1 and B1.2. In addition, the staff's review of the applicant's TLAA identification process is documented in SER Section 4.1.2.

LRA Table 3.5.1, item 3.5.1-42, states that Group B1.3 is applicable to BWR and not applicable to a PWR. The staff noted that the GALL Report defines Group B1.3 as being applicable to BWR plants. Therefore, the staff finds that Group B1.3 is not applicable because CR-3 is a PWR design.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's Quality Assurance program.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-19, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-19, via generic notes F through J, the applicant indicated which combinations of component type, material, environment, and AERM do not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Reactor Building – Summary of Aging Management Review – LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the reactor building component groups.

LRA Tables 3.5.2-1, 3.5.2-2, 3.5.2-4, 3.5.2-5, 3.5.2-6, 3.5.2-9, 3.5.2-10, 3.5.2-11, 3.5.2-12, 3.5.2-13, 3.5.2-14, 3.5.2-16, 3.5.2-17, 3.5.2-18, and 3.5.2-19 list the aging effect and AMP as none for carbon steel, stainless steel, and galvanized steel anchorage and embedment component groups embedded in concrete. The AMR line items cite generic note J and plant-specific note 501, which state that carbon, stainless, and galvanized steel completely encased in concrete has no aging effect. The plant-specific note also lists several GALL Report generic items (RP-01, RP-06, EP-5, EP-20, SP-2, SP-13, and AP-19) related to carbon and stainless steel piping components which list the aging effect and AMP as none.

The staff reviewed the LRA items under consideration as well as the applicant's assertion that no aging effects are present. The staff noted that the above listed generic GALL Report items refer to piping components generally located in areas of the plant in which the concrete is expected to remain dry. The staff also noted that the GALL Report contains several items (generic item T-05) in which concrete may be exposed to moisture. In these cases, the GALL Report identifies aging effects of cracking, loss of bond, and loss of material due to corrosion of embedded steel, which are managed by the Structures Monitoring Program. Given that the LRA items under consideration occur throughout the plant, including locations where moisture may be present in the concrete, the staff required additional information on why the LRA items were not compared to the GALL Report items in which moist concrete may occur. To clarify this, the staff issued RAI 3.5.2.3-1 by letter dated November 3, 2009.

In its response, dated December 3, 2009, the applicant explained that the use of the mechanical line items in the LRA was appropriate because the mechanical line items contained the same material and environment as the structural commodity. The applicant further explained that for these items, the concrete is assumed to have high alkalinity and although it may be subjected to moisture, it is not subjected to an aggressive environment as defined in the GALL Report.

The staff reviewed the applicant's response and found it acceptable, because it explains why the applicant compared the structural LRA line items to GALL Report mechanical line items and explains that the concrete for these line items is not subjected to an aggressive environment;

therefore, even if the concrete is exposed to moisture, the alkalinity of the concrete should protect the embedded steel. In addition the applicant will monitor the concrete for indications of aging with the Structures Monitoring Program. The staff's concern described in RAI 3.5.2.3-1 is resolved. Based on the staff's review, including the response to RAI 3.5.2.3-1, the staff finds the proposed AMRs acceptable.

The staff's evaluation for carbon steel cranes exposed to indoor or outdoor air with no aging effect requiring managing, with generic note I, is documented in SER Section 3.3.2.2.1.

In LRA Tables 3.5.2-1, 3.5.2-2, 3.5.2-6, 3.5.2-11, and 3.5.2-14, the applicant stated that fire barrier assemblies constructed from various fire proofing materials exposed to indoor or outdoor air are being managed for loss of material, cracking due to delamination, and separation by the Fire Protection Program. The applicant referenced generic note J for these items indicating that neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant also cited plant-specific notes 502 (LRA Table 3.5.2-1 only) and 526, indicating that the fire proofing materials included Thermo-lag and Mecatiss fire barriers.

The staff noted that in the applicant's response to RAI 2.3.3.36-3 provided in letter dated September 30, 2009, the applicant stated that during the review for RAI 2.3.3.36-3 it was determined that there are no fire barrier assemblies located in the emergency feedwater pump building. Therefore, the applicant amended its LRA to remove fire barrier assemblies AMR from LRA table 3.5.2-11. The staff's evaluation of RAI 2.3.3.36-3 is documented in SER Section 2.3.3.36.2.

The staff reviewed the applicant's Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.6. The staff noted that the applicant's Fire Protection Program includes periodic visual inspections of fire barriers, such as the fire proofing materials wrapped around the electrical raceways. The staff also noted that gross degradation (e.g., loss of material, cracking due to delamination and separation) of fire barriers is detectable by visual inspection. The staff further noted that it is a common industry practice to examine the material condition of industrial fire barriers during periodic inspections. The staff finds the applicant's proposed AMR acceptable because it includes periodic visual inspections capable of detecting cracking due to delamination, separation, or loss of material.

LRA Table 3.5.2-1 contains items addressing unibestos insulation exposed to indoor air. The applicant cites note J for these AMR items. The applicant further proposes that this combination of environment and material is not subject to aging and that no AMP is required.

In its review of these items the staff noted that unibestos is an asbestos insulation product. The staff finds the applicant's proposal acceptable because asbestos insulation has been used in a wide variety of industrial applications for many years due to, at least in part, its inertness, (i.e., its lack of aging).

In LRA Table 3.5.2-1 the applicant stated that the stainless steel penetration sleeves exposed to indoor air does not have an aging effect, therefore an AMP is not required. The AMR line items cite generic note I, indicating that for this line item, the aging effect in the GALL Report for this line item's component, material and environment combination is not applicable. The AMR line items also cite plant-specific note 513 that states the component type includes the exterior surface of the stainless steel fuel transfer tubes, blind flanges, bolting, and cover plates and the dissimilar metal welds at the stainless steel fuel transfer tube/carbon steel penetration sleeve interface located in the Reactor Building because the fuel transfer tube is examined by the

ASME Section XI, Subsection IWE Program and the 10 CFR Part 50, Appendix J Program. It further states the AMR methodology concluded cracking due to SCC in the air-indoor environment was not applicable because the stainless is not exposed to an aggressive environment.

The staff evaluated the LRA AMR information on stainless steel penetration sleeves exposed to indoor air. The applicant referenced the GALL Report AMR item II.A3-2, in LRA Table 3.5.2-1 for this aging effect. The GALL Report recommends the use of the ASME Section XI, Subsection IWE Program, 10 CFR Part 50, Appendix J Program, and additional appropriate examinations/evaluations for bellows assemblies and dissimilar metal welds.

By letter dated December 1, 2009, the staff issued RAI 3.3.2.2-1 requesting that the applicant provide additional information on why atmospheric chloride induced stress corrosion cracking does not need to be evaluated for an air-indoor environment and why no AMP has been assigned to these components.

In its response dated December 30, 2009, the applicant stated that its plant-specific operating experience supports the conclusion that pitting and crevice corrosion and cracking are not a concern in air-indoor environments. The applicant stated that cracking due to SCC of stainless steel is not a concern in indoor environments but may be a concern in continuously or frequently wetted locations in outdoor environments if temperatures are greater than 140 °F (60 °C), or if plant operating experience shows exposure to salt air or other aggressive species.

Based on its review, the staff finds the applicant’s response to RAI 3.3.2.2-1 acceptable because these components are located in an indoor air environment that are not subjected to temperatures that are greater than 140 °F (60 °C) and/or contain salt air or other aggressive species and the applicant’s plant-specific operating experience does not support that cracking due to SCC is occurring in an air-indoor environment. The staff’s concern described in RAI 3.3.2.2-1 is resolved. Based on the staff’s review, including the response to RAI 3.3.2.2-1, the staff finds the proposed AMRs acceptable because the components are not subject to an aggressive chemical environment and, therefore, not subject to aging.

LRA Tables 3.5.2-1 and 3.5.2-5 contain items for Fluorogold slide bearings installed on structural steel components exposed to indoor air items being managed for changes in material properties and lock-up by the Structures Monitoring Program (reviewed in SER Section 3.0.3.2.14). The applicant cites note J for these AMR items. The applicant stated in plant-specific note 510 that, “The same aging effect used for NUREG-1801, items III.A4-6, for Lubrite® plates (lock-up) is assigned to Fluorogold slide bearing plates used on structural steel. In addition, CR-3 determined changes in material properties due to radiation exposure is an applicable aging effect. The Structures Monitoring Program is credited for inspecting the slide bearing plates which includes the Fluorogold plates.”

In its review of these items the staff noted that the Structures Monitoring Program is specific to each plant and that the applicant selects the parameters monitored to ensure aging degradation can be detected. The staff also noted that the Fluorogold material of the slide bearing is filled Teflon which is substantially inert in air. The staff finds the applicant’s proposal to manage the aging of these components with the Structures Monitoring Program to be acceptable because appropriate inspection techniques are included in the program and the material is unlikely to experience any appreciable aging.

LRA Tables 3.5.2-1, 3.5.2-2, and 3.5.2-14 contain items for Fluorogold slide bearings installed on supports for ASME Class 1, 2, and 3 piping and components exposed to indoor and outdoor air being managed for changes in material properties and loss of mechanical function by the ASME Section XI Subsection IWF Program (reviewed in SER Section 3.0.3.1.15). The applicant states that neither the component nor the material and environment combination is evaluated in the GALL Report (note J). The applicant also stated in plant-specific note 511 that, "The same aging effect used for NUREG-1801, items III.B1.1-5 and III.B1.2-3, for Lubrite® plates (loss of mechanical function) is assigned to Fluorogold slide bearing plates used on supports. In addition, CR-3 determined change in material properties due to exposure to radiation is an applicable aging effect. The ASME Section XI, Subsection IWF Program is credited for inspecting the slide bearing plates which includes the Fluorogold plates."

In its review of these items the staff noted that the ASME Section XI, Subsection IWF Program specifies the use of visual examinations (VT-3) and lists specific portions of the piping supports, including the sliding surfaces, which are to be examined. The staff also noted that the Fluorogold material of the slide bearing is filled Teflon which is substantially inert in air. The staff finds the applicant's proposal to manage the aging of these components with the ASME Section XI Subsection, IWF Program to be acceptable because appropriate inspection techniques are included in the procedure and the material is unlikely to experience any appreciable aging.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Auxiliary Building-Summary of Aging Management Review–LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the auxiliary building component groups.

In LRA Tables 3.5.2-2 and 3.5.2-6, the applicant stated no AERM and no AMP are required for copper components in an environment including borated water leakage. The LRA includes plant-specific note 525 with this AMR item. Note 525 states that the CR-3 AMR methodology concluded that copper materials in air-indoor or borated water leakage environment have no aging effect. This applies only to straps for copper tubing. Also a generic note J is assigned to this line item which indicates that neither the component nor the material and environment combination is evaluated in the GALL Report.

The staff found that the GALL Report, item V.E-11 (EP-38) recommends the program described in GALL AMP XI.M10, "Boric Acid Corrosion," for copper alloy in air with borated water leakage, with the associated aging effect loss of material due to boric acid corrosion.

By letter dated November 3, 2009, the staff issued RAI 3.5.2.3-4, requesting the applicant to justify why loss of material is not an aging effect of concern for copper components in an environment that includes borated water leakage.

In its response, dated December 3, 2009, the applicant stated that in LRA Table 3.5.2-2 for the AB, the commodity "Cable Tray, Conduit, HVAC Ducts, Tube Track" for copper material in a Borated Water Leakage environment should have had an aging effect of loss of material, an

AMP of Boric Acid Corrosion, referencing GALL Report, item VI1.1-12 (AP-66); a Table 1 item of 3.3.1-88, and generic note C with no plant-specific note.

The applicant changed the plant-specific note 525 to read: "The CR-3 aging management review methodology concluded that copper material in an air-indoor environment has no aging effects. This applies only to straps for copper tubing." The above changes to the LRA are addressed further in enclosure 2 of the letter from the applicant to NRC dated December 3, 2009.

Since the applicant has revised the LRA to assign the appropriate aging effect and the appropriate GALL Report recommended AMP, the staff's concern in RAI 3.5.2.3-4 is resolved. Based on the staff's review, including the response to RAI 3.5.2.3-4, the staff finds the proposed AMRs acceptable.

In the LRA Tables 3.5.2-2, 3.5.2-5, 3.5.2-8, and 3.5.2-9, the applicant proposed to manage loss of material, cracking, and change in material properties for reinforced concrete exposed to a raw water – seawater environment by using the Structures Monitoring Program. The AMR line items cite note G, which indicates that the environment is not in the GALL Report for the component and material. The line items also cite plant-specific note 543 which explains that CR-3 Group 3 and 6 structures have concrete components in a raw water – seawater environment. The note further explains that this environment is not addressed by the GALL Report for these aging effects because the seawater environment at CR-3 is aggressive, the sulfate content is greater than 1500 ppm, and the chloride content is greater than 500 ppm.

The staff reviewed the AMR line items and found that although the environment 'raw water-seawater' is not in the GALL Report, the AMR line items closely match GALL Report items III.A3-4, III.A3-5, III.A6-1, and III.A6-3. These GALL Report items discuss concrete exposed to a groundwater/soil environment, as well as the inaccessible portions (e.g., below-grade) of concrete in an outdoor air environment. All of these items recommend that a plant-specific AMP should be implemented to manage the inaccessible concrete at plants with aggressive groundwater. Since the structures in the referenced AMR items are exposed to aggressive seawater, the staff is unsure how the Structures Monitoring Program is addressing the possibility of increased degradation. Therefore, by letter dated November 3, 2009, the staff issued RAI 3.5.2.2.2.2-3 asking the applicant to explain how the aging of these components is managed.

In its response, dated December 3, 2009, the applicant explained that since the GALL Report did not include a specific line item with a raw water or water-flowing environment which required a plant-specific program, a plant-specific program was not provided. The applicant explained that the Structures Monitoring Program is adequate to manage aging of concrete submerged in aggressive seawater because of the following:

- The concrete is accessible for visual inspection by divers or by draining portions of the structure;
- The periodic inspection frequency is 5 years as specified in ACI 349.3R;
- A reassessment of the inspection frequency based on the results of the inspection is required;
- Plant operating experience has identified no unacceptable concrete aging effects due to the aggressive seawater environment.

The staff reviewed the applicant's response and finds it acceptable because the concrete is being visually inspected on a frequency commensurate with industry standards for water-control structures, and the applicant has no operating experience which would indicate the current inspection interval is unacceptable for structures exposed to raw water. In addition the applicant has procedures in place to shorten the inspection interval if degradation is detected during future inspections. Based on the staff's review, including the response to RAI 3.5.2.2.2.2-3, the staff finds the proposed AMRs acceptable.

The staff's evaluation for carbon steel cranes exposed to indoor or outdoor air with no aging effect requiring managing, with generic note I, is documented in SER Section 3.3.2.2.1.

The staff's evaluation for fire barrier assemblies exposed to indoor or outdoor air subject to loss of material, cracking due to delamination, and separation managed by the Fire Protection Program with generic note J, is documented in SER Section 3.5.2.3.1.

In LRA Table 3.5.2-2, the applicant included an AMR for Boral spent fuel storage racks exposed to treated water that proposed no aging effects requiring management and, therefore, required no AMP. The AMR item refers to note I which indicates that the aging effect for this component, material and environment combination is not evaluated in the GALL Report. This AMR item also referred to plant-specific note 528 which stated that "the CR-3 aging management review methodology determined that there are no aging effects for Boral. There has been no adverse operating experience recorded for CR-3 or Harris Nuclear Plant. Both the V.C. Summer Nuclear Station and the Brunswick Steam Electric Plant have been evaluated by the NRC staff for these aging effects, and the License Renewal Safety Evaluation Reports for those plants have determined the aging effects to be insignificant." Also in LRA Table 3.5.2-2 the applicant proposed to manage Carborundum (B_4C) spent fuel storage racks exposed to treated water with the Carborundum (B_4C) Monitoring Program. The LRA cites note F for this AMR item which indicates the material for this component/environment combination is not evaluated in the GALL Report. The applicant also included plant-specific note 540 for this AMR which states that "the CR-3 aging management review methodology determined that Carborundum (B_4C) has the aging effect Loss of Material, which will be managed by the Carborundum (B_4C) Monitoring Program."

By letters dated September 2 and November 30, 2009, the staff issued RAI B.2.37-1 and RAIs B.2.37-2 and 3.3.2.2.6-2 respectively, requesting the applicant provide additional information related to the aging management of both Boral and Carborundum (B_4C) in the spent fuel pool. The applicant responded to RAIs B.2.37-2 and 3.3.2.2.6-2 by letter dated January 27, 2010, and revised the AMR items for both Boral and Carobrundum (B_4C) in part by deleting the Carborundum (B_4C) Monitoring Program and establishing the Fuel Pool Rack Neutron Absorber Monitoring Program for aging management of both Boral and Carobrundum (B_4C) spent fuel pool racks. The staff's evaluation of RAIs B.2.37-1, B.2.37-2, and 3.3.2.2.6-2 and the Fuel Pool Rack Neutron Absorber Monitoring Program is documented in SER Section 3.0.3.3.1.

As stated above, the applicant's letter dated January 27, 2010 revised the AMRs for Boral and Carborundum (B_4C) spent fuel pool racks exposed to treated water. The applicant combined the aging management of Boral and Carborundum (B_4C) into one AMR that notes aging effects requiring management of reduction of neutron absorbing capacity, loss of material, and change in dimensions to be managed by the Fuel Pool Rack Neutron Absorber Monitoring Program. The revised AMR cites note F and refers to plant-specific note 540. The applicant deleted plant-specific note 528 which had been applicable to the Boral AMR item and revised plant-specific note 540 to state that "the CR-3 AMR incorporates the recommendations of

LR-ISG-2009-01, and manages CR-3 fuel pool rack neutron absorbing materials for the aging effects Reduction of Neutron-Absorbing Capacity, Change in Dimensions, and Loss of Material with the Fuel Pool Rack Neutron Absorber Monitoring Program."

The staff finds the applicant's proposed aging management review of Boral and Carborundum (B_4C) spent fuel pool racks exposed to treated water acceptable because the applicant has identified aging effects and credited an AMP that will manage the effects of aging consistent with the recommendations of LR-ISG-2009-01.

The staff's evaluation of Fluorogold slide bearings installed on supports for ASME Class 1, 2, and 3 components exposed to indoor or air subject to changes in material properties and loss of mechanical function managed by ASME Section XI, Subsection IWF Program with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Wave Embankment Protection Structure-Summary of Aging Management Review-LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the wave embankment structure component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.5.2.3.4 Borated Water Storage Tank Foundation and Shield Wall-Summary of Aging Management Review–LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the borated water storage tank foundation and shield wall component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.5 Cable Bridge-Summary of Aging Management Review–LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the cable bridge component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for submerged concrete exposed to raw water-seawater managed for loss of material, cracking, and change of material properties by the Structures Monitoring Program, with generic note G, is documented in SER Section 3.5.2.3.2.

The staff's evaluation for Fluorogold slide bearings installed on structural steel components exposed to indoor and outdoor air subject to change in material properties managed by the Structures Monitoring Program with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Control Complex-Summary of Aging Management Review–LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the control complex component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for copper components exposed to indoor air with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.2.

LRA Table 3.5.2-6 contains items addressing control room ceiling panels constructed of melamine (Willtec) foam exposed to indoor air. The applicant proposes that neither the component nor the material and environment combination is evaluated in the GALL Report (note J). The applicant further proposes that this combination of environment and material is not subject to aging and that no AMP is required. In plant-specific note 530, the applicant stated that the aging management review methodology concluded that there are negligible aging effects associated with the Control Room ceiling Willtec foam panels. Additionally, plant operating experience has identified no aging effects.

In its review of these items the staff notes that, at least one manufacturer of melamine foam acoustic insulation panels lists the life expectancy of these panels as 12-14 years under normal conditions and 7-11 years under high humidity conditions.

By letter dated December 1, 2009, the staff issued RAI 3.5.2.3-1 requesting that, based on the advertised life expectancy of melamine foam, the applicant justify its position that this material is not subject to aging in indoor air.

In its response dated December 30, 2009, the applicant stated that the panels are SONEXone panels made of open cell Willtec acoustical foam, and based on manufacturer's input have no ill effects due to aging except for some slight change in dimensions due to changes in humidity.

The applicant also stated that the panels are located in the humidity-controlled control room and no aging has been detected to date with twelve years of service.

The staff finds the applicant's response acceptable because the specific manufacturer stated that there are no significant aging effects, the humidity controls of the control room will prolong life and the ceiling tiles are in near constant observation by control staff such that degradation would be detected and addressed prior to multiple failures. The staff's concern described in RAI 3.5.2.3-1 is resolved. Based on the staff's review, including the response to RAI 3.5.2.3-1, the staff finds the proposed AMRs acceptable.

The staff's evaluation for fire barrier assemblies exposed to indoor or outdoor air subject to loss of material, cracking due to delamination, and separation managed by the Fire Protection Program with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.7 Intake and Discharge Canals-Summary of Aging Management Review-
LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the intake and discharge canals component groups. The staff's review did not identify any line items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for this system are consistent with the GALL Report.

3.5.2.3.8 Circulating Water Discharge Structure-Summary of Aging Management Review–
LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the circulating water discharge structure component groups.

The staff's evaluation for submerged concrete exposed to raw water-seawater managed for loss of material, cracking, and change of material properties by the Structures Monitoring Program, with generic note G, is documented in SER Section 3.5.2.3.2.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.9 Circulating Water Intake Structure-Summary of Aging Management Review–
LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the circulating water intake structure component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for submerged concrete exposed to raw water–seawater managed for loss of material, cracking, and change of material properties by the Structures Monitoring Program, with generic note G, is documented in SER Section 3.5.2.3.2.

The staff's evaluation for carbon steel cranes exposed to indoor or outdoor air with no aging effect requiring managing, with generic note I, is documented in SER Section 3.3.2.2.1.

In LRA Table 3.5.2-9 the applicant stated that stainless steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures exposed to raw water are being managed for loss of material by the Structures Monitoring Program. The applicant cited note J.

The staff reviewed the applicant's Structures Monitoring Program, and its evaluation is documented in SER Section 3.0.3.2.14. The applicant stated that this program includes periodic inspections to monitor the conditions of structures and structural components to ensure that aging degradation will be detected. The staff finds the applicant's Structures Monitoring Program acceptable to manage loss of material of stainless steel components exposed to raw water because periodic inspections are an appropriate technique to manage this aging effect.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.10 Diesel Generator Building-Summary of Aging Management Review-
LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the diesel generator building component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.11 Emergency Feedwater Pump Building-Summary of Aging Management Review–
LRA Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the EFW pump building groups.

The staff's evaluation for carbon and stainless steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for carbon steel cranes exposed to indoor or outdoor air with no aging effect requiring managing, with generic note I, is documented in SER Section 3.3.2.2.1.

The staff's evaluation for fire barrier assemblies exposed to indoor or outdoor air subject to loss of material, cracking due to delamination, and separation managed by the Fire Protection Program with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.12 Dedicated Emergency Feedwater Tank Enclosure Building-Summary of Aging Management Review–LRA Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the dedicated EFW tank enclosure building component groups.

The staff's evaluation for carbon and stainless steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

In LRA Table 3.5.2-12, CR-3 has credited the Structures Monitoring Program for managing the aging effect loss of material of carbon steel and stainless steel in treated water. Also, the applicant has added plant-specific notes 546 and 527. Note 546 states that the CR-3 aging management review methodology concluded that carbon steel in a treated water environment has the aging effect of loss of material. Note 527 states that the CR-3 methodology concluded that stainless steel conduits and support steel located in the dedicated EFW Tank Enclosure Building northwest corner recessed area (similar to a sump) will have the aging effect of loss of material. Also for these two line items, the applicant has cited generic note G which represents an environment not in the GALL Report for this component and material.

The staff reviewed the AMR line items and found that for similar material, environment, and aging effects combination involving stainless steel and steel, treated water, and loss of material, in the GALL Report, item VII.E3.15 (A-58), and VII.E3-18 (A-35) recommend the AMP described in GALL Report section XI.M2, "Water Chemistry" BWR water. Also the GALL Report recommends that the AMP is to be augmented by verifying the effectiveness of water chemistry control. An acceptable verification program is recommended in the GALL Report chapter XI.M32, "One-Time Inspection." The staff is unsure how the Structures Monitoring Program is addressing the loss of material of carbon steel and stainless steel material exposed to treated water. Therefore, by letter dated November 3, 2009, the staff issued RAI 3.5.2.3-3, requesting the applicant to explain how the Structures Monitoring Program will monitor and manage the aging of these components.

In its response, dated December 3, 2009, the applicant stated that the system engineer performs visual inspection of this area including the stainless steel components in the sump during quarterly walkdowns in addition to the inspection conducted for Structures Monitoring Program. During the February 2009 system walkdown, the applicant initiated the activities to clean the sump, and restore the coating of the sump and the supports within the sump. The applicant also determined to revise the plant-specific notes 527 and 546 and the revised notes are added in enclosure 2 of the letter from CR-3 to NRC dated December 3, 2009.

The staff reviewed the response and found it acceptable because the applicant explained that the components are accessible for visual inspection and they are being inspected under the Structures Monitoring Program with an acceptable frequency. Based on the staff's review, including the response to RAI 3.5.2.3-3, the staff finds the proposed AMRs acceptable.

The staff's evaluation for reinforced concrete exposed to treated water is equivalent to the evaluation of submerged concrete exposed to raw water-seawater managed for loss of material, cracking, and change of material properties by the Structures Monitoring Program, with generic note G. This evaluation is documented in SER Section 3.5.2.3.2.

For one group, in LRA Table 3.5.2-12, the applicant proposed to manage stainless steel material in treated water for the aging effect loss of material with the ASME Section XI, Subsection IWF Program. This line item references generic note G and plant-specific note 527, which states, "The CR-3 methodology concluded that stainless steel conduits and support steel located in the dedicated EFW tank enclosure building northwest corner recessed area (similar to a sump) will have the aging effect of loss of material." For two groups, in LRA Table 3.5.2-12, the applicant proposed to manage carbon steel material, aging effect loss of material and loss of mechanical function with the ASME Section XI, Subsection IWF Program. These lines item reference note G and plant-specific notes 546 and 547 (respectively), which states, "The CR-3 aging management review methodology concluded that carbon steel in a treated water environment has the aging effect of loss of material" and "The CR-3 aging management review methodology conservatively applied loss of mechanical function to a treated water environment to agree with air-indoor and air-outdoor environments" (respectively).

The staff's review of the ASME Section XI, Subsection IWF Program is documented in SER Section 3.0.3.1.15. The staff finds that the credited AMP is appropriate because, the ASME Section XI, Subsection IWF Program performs visual inspections on a periodic basis to manage any degradation (e.g., loss of material, loss of mechanical function, etc.). Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.13 Fire Service Pumphouse-Summary of Aging Management Review– LRA Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the fire service pumphouse component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

Based on its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.14 Intermediate Building-Summary of Aging Management Review–LRA Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the intermediate building component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

LRA Tables 3.5.2-14 and 3.5.2-19 list the aging effect and AMP as none for PVC anchorage and embedment component groups embedded in concrete. The AMR line items cite note J and plant-specific note 501, which states that PVC completely encased in concrete has no aging effect.

The staff reviewed the AMR lines and finds that PVC completely encased in concrete would have no aging effect. The staff based this conclusion on information in the Engineered Materials Handbook: Engineering Plastics, 1988, which stated that PVC is relatively unaffected by water and concentrated alkalis. These would be the possible degradation mechanisms for PVC encased in concrete. Therefore the staff finds the applicant's proposed AMR acceptable.

The staff's evaluation for fire barrier assemblies exposed to indoor or outdoor air subject to loss of material, cracking due to delamination, and separation managed by the Fire Protection Program with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for Fluorogold slide bearings installed on supports for ASME Class 1, 2, and 3 components exposed to indoor air or air subject to changes in material properties and loss of mechanical function managed by ASME Section XI, Subsection IWF Program with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.15 Machine Shop-Summary of Aging Management Review-LRA Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the machine shop component groups.

By letter dated September 11, 2009, the applicant submitted LRA Amendment No. 2 which included an AMR for carbon steel anchorage/embedment in reinforced concrete with no aging effect requiring management and, therefore, no AMP. The applicant cited note J. The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.16 Miscellaneous Structures-Summary of Aging Management Review-
LRA Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the miscellaneous structures component groups.

The staff's evaluation for carbon and stainless steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

In LRA Table 3.5.2-16, the applicant stated that carbon steel platforms, pipe whip restraints, jet impingement shields, masonry wall supports, and other miscellaneous structures exposed to soil are being managed for loss of material using the One-Time Inspection Program. The AMR line items cite generic note J.

The staff reviewed all AMR result lines in the GALL Report for this component and material combination and noted that loss of material due to general, crevice, pitting, and microbiologically-influenced corrosion of steel piping, piping components, and piping elements exposed to soil is managed by the Buried Piping and Tanks Surveillance Program or the Buried Piping and Tanks Inspection Program (e.g., GALL item V.B-9). The staff also noted that the Buried Piping and Tanks Inspection Program uses visual inspection to detect loss of material for the pressure retaining portions of piping or tanks that are excavated for maintenance. The staff further noted that the One-Time Inspection Program also performs visual inspections capable of detecting loss of material and includes inspections of structural non-pressure retaining components. The staff reviewed the applicant's One-Time Inspection Program, and its evaluation is documented in SER Section 3.0.3.1.11. The staff finds the proposed AMP acceptable to manage aging for these components because the One-Time Inspection Program performs visual inspections that are capable of detecting loss of material for carbon steel structural components exposed to soil.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.17 Switchyard for Crystal River Site-Summary of Aging Management Review-LRA Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the switchyard for Crystal River site component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.18 Switchyard Relay Building-Summary of Aging Management Review-LRA Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the switchyard relay building component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.19 Turbine Building-Summary of Aging Management Review-LRA Table 3.5.2-19

The staff reviewed LRA Table 3.5.2-19, which summarizes the results of AMR evaluations for the turbine building component groups.

The staff's evaluation for carbon steel anchorage/embedment components exposed to reinforced concrete with no aging effect and, therefore, no AMP, with generic note J, is documented in SER Section 3.5.2.3.1.

The staff's evaluation for PVC anchorage and embedment components with no aging effect, with generic note J, is documented in SER Section 3.5.2.3.14.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the structures and component supports components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls System

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and instrumentation controls system components and component groups of the following:

- non-EQ insulated cables and connections (including splices, connectors, fuse holders, and terminal blocks)
- electrical portions of EIC penetration assemblies
- metal-enclosed bus and connections
- high-voltage insulators
- switchyard bus and connections
- transmission conductors and connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and instrumentation and controls (EIC) system components and component groups. LRA Table 3.6.1, "Summary of AMPs for the Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the EIC system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the EIC system components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.6.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations are consistent with the SRP-LR Section 3.6.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.6.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed are appropriate for the material and environment combinations specified. The staff's evaluations are documented in SER Section 3.6.2.3.

For SSCs which the applicant claimed are not applicable or required no aging management, the staff reviewed the AMR items and the plant's operating experience to verify the applicant's claims.

Table 3.6-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.6 and addressed in the GALL Report.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 EQ requirements (3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Yes	TLAA	Consistent with GALL Report (See SER Section 3.6.2.2.1)
Electrical cables, connections, and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (3.6.1-2)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables and Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (3.6.1-3)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements Program	Consistent with GALL Report
Conductor insulation for inaccessible medium-voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements (3.6.1-4)	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water, and trees	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	No	Inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements Program	Consistent with GALL Report
Connector contacts for electrical connectors exposed to borated water leakage (3.6.1-5)	Corrosion of connector contact surfaces due to intrusion of borated water	Boric Acid Corrosion	No	Boric Acid Corrosion Program	Consistent with GALL Report
Fuse holders (not part of a larger assembly): Fuse holders-metallic clamp (3.6.1-6)	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	No	Fuse Holder Program	Not consistent with GALL Report (See SER Section 3.6.2.3)
Metal-enclosed bus connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Metal Enclosed Bus Program	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metal-enclosed bus - insulation, insulators (3.6.1-8)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Metal Enclosed Bus Program	Consistent with GALL Report
Metal-enclosed bus - enclosure assemblies (3.6.1-9)	Loss of material due to general corrosion	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report
Metal-enclosed bus - enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomer degradation	Structures Monitoring Program	No	Metal Enclosed Bus Program	Consistent with GALL Report (See SER Section 3.6.2.1.1)
High-voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific AMP is to be evaluated	Yes	High-Voltage Insulators in the 230-kV Switchyard Program	Consistent with GALL Report (See SER Section 3.6.2.2.2)
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific AMP is to be evaluated	Yes	Not applicable	Not applicable to CR-3 (See SER Section 3.6.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Cable connections - metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical cable connections not subject to 10 CFR 50.49 EQ requirements Program	Consistent with GALL Report
Fuse holders (not part of a larger assembly) - insulation material (3.6.1-14)	None	None	NA	NA	Consistent with GALL Report

The staff's review of the EIC system component groups followed any one of several approaches. One approach, documented in SER Section 3.6.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.6.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.6.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the EIC system components is documented in SER Section 3.0.3.

3.6.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the EIC system components:

- Boric Acid Corrosion Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Fuse Holder Program
- High-Voltage Insulators in the 230-kV Switchyard Program

- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

- Metal Enclosed Bus Program

LRA Table 3.6.2-1 summarizes AMRs for the EIC system components and indicates AMRs claimed to be consistent with the GALL Report.

As discussed in SER Section 3.0.2.2.2, the applicant provided AMR results which cited generic notes A through J to indicate the AMR's consistency with the GALL Report. The staff reviewed the information in the LRA for AMRs that the applicant claimed were consistent with the GALL Report (i.e., those AMR items the applicant cited generic notes A through E). The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the EIC systems components that are subject to an AMR. For those AMRs that the applicant claimed consistency, the staff compared the LRA AMRs to the corresponding GALL Report AMRs to verify the applicant's claim of consistency. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable, and no further staff review is required.

3.6.2.1.1 Hardening and Loss of Strength due to Elastomers Degradation

In LRA Table 3.6.1, item 3.6.1-10, in the discussion column, the applicant stated that the Metal Enclosed Bus Program is credited for the aging management of elastomer seals associated with MEB enclosure assemblies. The applicant further stated that the Metal Enclosed Bus Program performs internal inspection of the enclosure assembly for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of moisture intrusion which may indicate degradation of the elastomer seal. The staff noted that in the AMR results that reference Table 3.6.1, item 3.6.1-10, the applicant included a reference to note E, indicating that this item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the AMR result lines referenced to note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the Structures Monitoring Program, the applicant proposed the Metal Enclosed Bus Program. The applicant stated that it proposed to perform internal inspection of the enclosure assembly for foreign debris, excessive bus buildup, and evidence of moisture intrusion as an evidence of elastomer degradation. However, inspecting the internal portion of the MEB may not detect aging of elastomers because elastomers are installed between transformers and the bus duct, and there is no direct relationship between moisture intrusion and degradation of the elastomer. Internal MEB moisture intrusion or dust buildup could be from other sources such as a missing seal at the panel below or above the bus duct.

The staff audited the Metal Enclosed Bus Program and noted that the applicant did not discuss the inspection of elastomers. However, the applicant proposed to credit the Metal Enclosed Bus Program for elastomer inspections without directly inspecting the elastomer under the program. In a letter dated September 30, 2009, the staff issued RAI 3.6-1 and requested the applicant to explain how internal inspection of MEBs will detect elastomer degradation.

In a letter dated December 30, 2009, the applicant stated that the inspection required by GALL AMP XI.S6, "Structures Monitoring Program," will be integrated into the overall Metal Enclosed Bus Program. Prior to entering the bus, the applicant will inspect gaskets on bus duct covers for crumbling, cracking or hardening which could permit water to enter the bus. Once inside, the applicant will perform an internal inspection of areas where sealant/caulking has been utilized and resealed as necessary. The applicant further stated that these inspections comply with the recommendations of GALL AMPs XI.S6, and XI.E4. The staff finds the applicant's response acceptable because the applicant will inspect the elastomer for crumbling, cracking, or hardening which could permit water to enter the bus and degrade the bus connection. This inspection is consistent with the GALL AMP XI.S6. The staff's concern described in RAI 3.6-1 is resolved.

3.6.2.1.2 Conclusion

The staff evaluated the GALL Report AMR items that the applicant claimed were not applicable. On the basis of its review, the staff concludes that the AMR results which the applicant claimed were not applicable were not applicable.

As discussed in SER Section 3.6.2.1, for those AMRs that the applicant claimed consistency with the GALL Report, the staff evaluated the applicant's claim of consistency. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent.

Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.6.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the EIC system components and provided information concerning how it will manage the following aging effects:

- electrical equipment subject to EQ
- degradation of insulator quality due to presence of any salt deposits and surface contamination, and loss of material due to mechanical wear
- loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load

- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.6.2.2. The staff's review of the applicant's further evaluation follows.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

LRA Table 3.6.1, item 3.6.1-01, refers to LRA Section 3.6.2.2.1 which states that EQ is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Presences of Any Salt Deposits and Surface Contamination, and Loss of Material Due to Mechanical Wear

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2.

LRA Table 3.6.1, item 3.6.1-11, refers to LRA Section 3.6.2.2.2, which addresses degradation of insulator quality due to salt deposits or surface contamination, and loss of material due to mechanical wear. The applicant stated that although CR-3 is located in a rural area, it is in close proximity to the Gulf of Mexico. The applicant further stated that site operating experience has shown that flashover of overhead transmission line insulators due to contamination from salt spray is an applicable aging mechanism that requires management. The applicant also stated that this aging mechanism is not applicable to the station post insulators in the 230-kV switchyard. The applicant stated that flashover of station post insulators has not been experienced at CR-3, which is attributed to the fact that station post insulators are oriented vertically whereas the overhead transmission line insulators may be angled to form various "string" configurations making them more susceptible to surface contamination. The applicant further stated that the overall length of a station post insulator is often longer than that of overhead transmission line insulators to meet the necessary clearance requirements for personnel safety in the switchyard. The applicant indicated that the longer overall length of a station post insulator increases the "creepage distance" of the insulator making it less susceptible to surface contamination. Therefore, the applicant stated that it will implement a plant-specific High-Voltage Insulators in the 230-kV Switchyard Program to preclude the buildup of surface contamination on overhead transmission line insulators in the 230-kV switchyard.

Regarding mechanical wear, the applicant stated that site operating experience has shown that mechanical wear resulting in loss of material to the steel pins connecting the insulators to one another is an applicable aging effect that requires management for the overhead transmission line insulators in the 230-kV switchyard. The applicant also stated that the same mechanical wear aging mechanism is not applicable to the station post insulator in the 230-kV switchyard. Station post insulators do not have steel swivel points like overhead transmission line insulators and are not susceptible to mechanical wear due to their mounting configuration. Therefore, the applicant will implement a plant-specific High-Voltage Insulators in the 230-kV Switchyard Program to mitigate this aging mechanism on overhead transmission line high-voltage insulators in the 230-kV switchyard.

The staff reviewed LRA Section 3.6.2.2.2 against SRP-LR Section 3.6.2.2.2 which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff noted surface contamination can be a problem in areas where greater concentration of airborne particles may occur, such as near facilities that discharge soot or near the sea coast where salt spray is a concern. CR-3 is located near the sea coast. Consequently, the rate of contamination buildup on the insulators could be significant. The applicant will implement a plant-specific High-Voltage Insulators in the 230-kV Switchyard Program to mitigate this aging effect.

The staff noted that mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact point of the insulator string and between an insulator and supporting hardware. CR-3 operating experience has shown that mechanical wear resulting in loss of material to the steel pins connecting the insulators to each other is an applicable aging effect for the overhead transmission line insulators in the 230 -kV switchyard. The applicant will implement a plant-specific High-Voltage Insulators in the 230-kV Switchyard Program. The staff reviewed the applicant's proposed AMP, and its evaluation is documented in SER Section 3.0.3.3.2. The staff finds the applicant-proposed AMP acceptable because it will visually inspect the high-voltage insulators for the evidence of surface contamination due to salt deposits and mechanical wear.

Based on the program identified above, the staff concludes that the applicant has met the SRP-LR Section 3.6.2.2.2 criteria. For those items that apply to LRA Section 3.6.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Pre-load

LRA Table 3.6.1, item 3.6.1-12, refers to LRA Section 3.6.2.2.3, which states that for switchyard bus and connections, the switchyard buses are connected to short lengths of flexible conductors that do not normally vibrate and are supported by station post insulators mounted on static, structural components such as cement footings and structural steel. The applicant stated that based on this design, wind-induced vibration is not an applicable aging mechanism. The applicant also stated that since there are no connections to moving or vibrating equipment, loss of material due to vibration is not an aging effect requiring management. The applicant further stated that the 230-kV switchyard aluminum bus exposed to service condition does not experience any appreciable aging effects except for minor oxidation, which does not impact the ability of the switchyard bus to perform its intended function. Therefore, the applicant concluded that general corrosion resulting in the oxidation of the switchyard bus is not an aging effect requiring management.

The applicant stated that bolted connections associated with the switchyard bus are for the connections to station post insulators used to support the bus. Other connections to the bus are welded. The components involved in switchyard bus connections are constructed from cast aluminum, galvanized steel, and stainless steel. No organic materials are involved. The applicant stated that connection materials exposed to the service conditions of the 230-kV switchyard do not experience any appreciable aging effects, except for minor oxidation, which does not impact the ability of the switchyard bus to perform its intended function. The steel bolting hardware used in this application has been selected because of its ability to inhibit rust. The applicant further stated that based on its operating experience, corrosion of the structural bolting used in this application is not significant enough to cause a loss of intended function.

For transmission conductors and connections, the applicant stated that transmission conductor mounting hardware loss of material due to wind-induced abrasion and fatigue is an applicable aging mechanism but is not significant enough to cause a loss of intended function. Wind-induced abrasion and fatigue could be caused by transmission conductor vibration resulting from wind loading. However, the applicant stated that a high wind loading factor of 135 mph (with an additional safety factor for wind gusts) has been considered in the design and installation of transmission conductors in the CR-3 transmission and distribution network. The applicant also stated that strong winds could cause the transmission conductors to sway from side to side. If this swinging is frequent enough, it could cause the transmission conductor's mounting hardware to wear. The applicant stated that although this mechanism is possible, experience by the applicant has shown that the transmission conductors do not normally swing and when they do, because of strong winds, they dampen quickly once the wind has subsided. Therefore, the applicant concluded that mounting hardware loss of material caused by transmission conductor vibration (sway) and fatigue is not an aging effect requiring management.

The applicant stated that loss of transmission conductor strength due to corrosion is an applicable aging effect but ample design margin ensures that it is not significant enough to cause a loss of intended function. All CR-3 transmission conductors are Type ACSR (aluminum conductor steel reinforced). The applicant stated that corrosion of ACSR transmission conductors is a very slow process that is even slower for rural areas with generally less suspended particles and SO_2 concentrations in the air than urban areas. The applicant also stated that CR-3 is located in a rural area where airborne particle concentrations are comparatively low.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. The National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to which will withstand under heavy load requirements, which includes consideration of ice, wind, and temperature. The applicant further stated that tests performed by Ontario Hydroelectric showed a 30 percent loss of composite conductor strength of an 80-year-old transmission conductor due to corrosion. Assuming a 30 percent loss of strength, the applicant stated that there would still be significant safety margin between what is required by the NESC and actual conductor strength. The applicant evaluated these requirements for applicability to the specific transmission conductors used at CR-3. The applicant used a typical 954 MCM ACSR transmission conductor in the 230-kV switchyard as an illustration. The ultimate strength of a 954 MCM (24/7 strand) ACSR conductor is 33,500 lbs, and the maximum design tension for this conductor is 15,000 lbs. The applicant stated that the margin between the maximum design tension and the ultimate strength is 18,500 lbs; i.e., the applicant stated that there is a 55.2 percent ultimate strength margin (18,500/33,500). The Ontario Hydroelectric study showed a 30 percent loss of composite conductor strength in an 80-year-old conductor. In the case of the CR-3 954 MCM ACSR transmission conductor, a 30 percent loss of ultimate strength would mean there would still be 25.2 percent ultimate strength margin between what is required by the NESC and the actual conductor strength in an 80-year old conductor. The applicant further stated that CR-3 transmission conductors within the scope of this review have relatively short spans. Therefore, the tension exerted on the conductors in the 230-kV switchyard is less than would be experienced in typical transmission applications. The applicant further stated that this evaluation shows that there is ample design margin in the transmission conductors at CR-3. In addition, the applicant stated that its analysis shows that the Ontario Hydroelectric test envelopes the transmission conductors at CR-3, and, based on the conservatism in ultimate strength margin, demonstrates that loss of conductor strength is not an aging effect requiring management for the ACSR transmission conductors within the scope of this review.

Regarding the aging effect of increased electrical resistance, the applicant stated that switchyard bus conductor connections are generally of the compression bolted category and that no organic materials are involved. The applicant also stated that connection materials exposed to the service conditions of the CR-3 230-kV switchyard do not experience any appreciable aging effects, except for minor oxidation, which does not impact the ability of the switchyard bus to perform its intended function. CR-3 transmission conductor connection surfaces are coated with an anti-oxidant compound (a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connection, thus reducing the chances of corrosion. The applicant also stated that based on operating experience, this method of installation has been shown to provide a corrosion-resistant, low-electrical-resistance connection. Therefore, the applicant concluded that general corrosion resulting in the oxidation of switchyard connection surface metals is not an aging effect requiring management.

The applicant further stated that only bolted connections associated with the transmission conductors are for the connections to the switchyard bus and for the connections to the high voltage bushings on the Backup Engineered Safeguards Transformer (BEST). The aluminum bolting hardware used for the connections to the switchyard bus was selected to be compatible with the aluminum connector/conductor coefficient of thermal expansion. This ensures that the contact pressure of the bolt and washer combination used in the connector is maintained to the initial vendor-specified torque value. CR-3 design incorporates the use of stainless steel Belleville washers on the bolted electrical connections to the main power transformers to compensate for temperature changes, maintain the proper torque, and prevent loosening of dissimilar metal connection hardware. This method of assembly is consistent with the good bolting practices recommended in EPRI Technical Report 1003471, "Electrical Connector Application Guidelines," December 2002. The applicant further stated that connection materials exposed to the service conditions of the CR-3 230-kV switchyard may experience minor oxidation but it is not significant enough to cause a loss of intended function.

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3 which states that loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff noted that transmission conductors do not significantly swing and that when they do, due to a substantial wind, do not continue to swing for very long once the wind has subsided. Wind loading that can cause transmission lines to vibrate is considered in the design and installation. In addition, the sections of transmission conductor within the scope of license renewal are short spans connecting the switchyard to the startup transformers and the surface areas exposed to wind loads are not as significant. Switchyard buses are connected to flexible conductors that do not normally vibrate and are supported by insulators, ultimately by static, structural components, such as cement footings and structural steel. The flexible conductors are bolted to other switchyard bus components such as disconnect switches, breakers, and transformers. The flexible conductors eliminate potential for vibration and wear is not an applicable aging effect because the flexible conductors are welded to switchyard buses. Based on this information, the staff determined that loss of material of transmission conductors due to vibration is not an aging effect requiring management.

The staff reviewed the testing program performed by Ontario Hydroelectric to determine whether CR-3 transmission conductors have adequate design margin to perform their intended function during the extended period of operation. The study showed about 30 percent loss of conductor strength in an 80-year old ACSR conductor due to corrosion. The NESC requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to which will withstand heavy load requirements, which include consideration of ½ inch of radial ice and 4 pounds per square feet (psf) wind. The staff reviewed the requirements concerning the specific conductors included in the AMR at CR-3. The applicant used a typical 954 MCM ACSR transmission conductor in the switchyard to illustrate how the transmission conductor aging due to corrosion is insignificant. The applicant stated that the ultimate strength of a 954 MCM (24/7 strand) ACSR conductor is 33,500 lbs. and the maximum design tension for this conductor is 15,000 lbs. The applicant also stated that the margin between the maximum design tension and the ultimate strength is 18,500 lbs. The applicant further stated that there is a 55.2 percent ultimate strength margin. With the loss 30 percent conductor strength due to corrosion, there would still be 25.2 percent ultimate strength margin between what is required by the NESC and the actual conductor strength in an 80-year old conductor.

The staff reviewed the applicant’s calculation, and noted that a loss of conductor strength of 30 percent on 954 MCM ACSR transmission conductors would mean that the conductor strength would be 23,450 lbs (33,500 lbs x 0.7). The ratio between the heavy loading and the ultimate conductor strength would be approximately 64 percent. The NESC requires that tension on installed conductor be a maximum of 60 percent of the ultimate conductor strength. The tension (heavy load) of a typical transmission conductor, as illustrated by the applicant, would exceed the NESC maximum requirement of 60 percent of the ultimate conductor strength. In a letter dated September 30, 2009, the staff issued RAI 3.6-2 and requested the applicant to explain why loss of conductor strength due to corrosion is not a significant aging effect requiring management at CR-3.

In response to the staff’s request, by letter dated December 3, 2009, the applicant stated that the 30 percent reduction in conductor strength used in the analysis is for an 80-year old conductor. For license renewal, the installed time frame for the conductor is actually 60 years. The applicant also stated that by simple ratio (30/80 = x/60) a 22.5 percent reduction in conductor strength is more appropriately established for license renewal. The loss of conductor strength of 22.5 percent on 954 MCM ACSR transmission conductors then becomes 25,962 lbs (33,500 lbs x 0.775) and the ratio between heavy loading and the ultimate conductor strength would be appropriately 58 percent and is bounded by the NESC requirement. The staff finds the applicant's response acceptable because with a loss of 22.5 percent of conductor strength, the ratio between the heavy loading and the ultimate conductor strength is still below the 60 percent NESC requirement. The staff noted that based on the Ontario Hydroelectric study, the loss of conductor strength would be about 17 percent which would result in a ratio between heavy loading and the ultimate conductor strength of about 54 percent. Therefore, the applicant's analysis is conservative. Furthermore, the staff noted that the length of transmission conductors in the scope of license renewal generally has a short span. These transmission conductors connecting the switchyard to the startup transformers provide restoration of offsite power after a station blackout (SBO) event. The loading of these transmission conductors is much less than the calculated heavy loading of a long span transmission line. Based on this information, the staff determined that the Ontario Hydroelectric testing program bounds the transmission conductors at CR-3 and loss of conductor strength due to corrosion of transmission conductor is not a significant aging effect requiring management for the period of extended operation. Therefore, the staff's concern about loss of conductor strength due to corrosion in RAI 3.6-2 is resolved.

The staff noted that the design of the transmission conductor bolted connections at CR-3 precludes torque relaxation and corrosion. The type of bolting plates and the use of stainless steel Belleville washers is the industry standard to preclude torque relaxation. CR-3 design incorporates the use of Belleville washers on bolted electrical connections of dissimilar metals to compensate for temperature changes, maintain the proper torque and prevent loosening. This method of assembly is consistent with the good bolting practices recommended by industry guidelines (EPRI TR-104213, "Bolted Joint Maintenance & Application Guide"). The bolted connections and washers are coated with an anti-oxidant compound (a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connection, thus reducing the chances of corrosion. This method of installation provides a corrosion-resistant, low-electrical-resistance connection. The staff finds the applicant's approach to managing torque relaxation and corrosion of bolted connections acceptable because using Belleville washers and anti-oxidant compound prior to tightening bolted connections is consistent with good bolting practices as recommended in EPRI TR-104213.

Based on the programs identified above, the staff concludes that the applicant has met the SRP-LR Section 3.6.2.2.3 criteria. For those items that apply to LRA Section 3.6.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's Quality Assurance Program.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6.2-1, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with, or not addressed in, the GALL Report.

In LRA Table 3.6.2-1, the applicant indicated, via notes F through J, which combinations of component type, material, environment, and AERM do not correspond to an item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

The staff reviewed LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the EIC components and component groups.

In LRA, Table 3.6.2-1 under Fuse Holders (Not Part of a Larger Assembly), the applicant indicated that the only aging effect requiring management is corrosion and oxidation for the metallic clamp of fuse holders. The applicant included generic note I and plant-specific note 603, indicating that the aging effect in the GALL Report for this component, material, and environment combination is not applicable. The applicant aligns this AMR to GALL Report, item VI.A-8, which identifies potential aging effects for metallic clips in fuse holders of fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation.

In note 603, the applicant stated that CR-3 fuse holders subject to an AMR are used in control valve and/or intermittent instrument and control (I&C) applications. The applicant further stated in note 603 that only fuses that could potentially be exposed to thermal cycling and ohmic heating are those that carry significant current in power supply applications. The applicant stated that I&C circuits characteristically operate at such low currents that no appreciable thermal cycling or ohmic heating occurs. The applicant further stated that because thermal cycling and ohmic heating apply to power supply applications, they are not considered applicable aging mechanisms for CR-3 fuse holders.

The applicant also stated that CR-3 electrical design ensures that stresses due to forces associated with electrical faults and transients are mitigated by the fast action of circuit protective devices at high currents. The applicant stated that mechanical stress due to electrical faults is not considered a credible aging mechanism because such faults are infrequent and random in nature. CR-3 fuses are not routinely pulled and/or manipulated to facilitate plant testing. Therefore, the applicant did not consider frequent manipulation an applicable aging mechanism.

The applicant also stated that vibration is induced in fuse holders by the operation of external equipment, such as compressors, fans, and pumps. The applicant's plant walkdown has verified that there are no direct sources of vibration for the fuse holder panels, and the panels are mounted separately to their own support structure on a concrete wall or column. Therefore, the applicant considered that vibration is not an applicable aging mechanism.

The applicant also stated that the plant walkdown verified that there are no potential sources of chemical contamination in the area and that the fuse holders are totally enclosed in a protective junction box which would provide protection even if chemical contamination were possible. Therefore, based on their installed location and design configuration, the applicant concluded that chemical contamination is not considered an applicable aging mechanism. The applicant also stated that the plant walkdown has verified that corrosion and oxidation are credible aging mechanisms for fuse holders located within the AB due to moisture. The moisture required to produce corrosion and oxidation is not present in other non-condensing areas of the plant. The applicant further stated that the Fuse Holder Aging Management Program will confirm the absence of corrosion and oxidation resulting from moisture on the metallic clamp. The scope of this program applies to fuse holders located in stand-alone junction boxes within the AB.

The staff finds that fatigue, mechanical stress, vibration, and chemical contamination stressors are not applicable at CR-3. Fatigue is the aging effect for plants that manipulate fuse to deenergize circuits for plant testing. The CR-3 fuses are not routinely pulled or manipulated for plant testing. Therefore, fatigue and mechanical stress are not applicable aging effects at CR-3.

Ohmic heating and thermal cycling are for fuses that carry high current in power supply applications or in heavy loading motors. The CR-3 fuses installed in I&C circuits operate at low current that do not experience thermal cycling or ohmic heating. Therefore, ohmic heating and thermal cycling are not applicable stressors at CR-3.

Stresses associated with mechanical stress due to electrical faults is not considered a creditable aging stressor since such faults are infrequent, and the fuse element design will interrupt the fault current in milliseconds. Forces associated with faults are mitigated by the fast action of fuse elements. Therefore, mechanical stress is not an applicable aging effect at CR-3.

Vibration is an applicable aging stressor for fuse holders that are mounted on moving equipment, such as motors, compressors, and pumps. CR-3 fuses are not mounted on moving or vibrating equipment. They are mounted on concrete wall or support structures that do not vibrate. Therefore, vibration is not an applicable stressor at CR-3.

Chemical contamination is a stress concentrator for fuse holders that are located near a chemical contamination source such as boric acid tanks. Fuse holders are enclosed in a protective panel that would provide protection against chemical attack. The applicant has verified that there is no potential source of chemical contamination in the areas near the fuse holders. Therefore, chemical contamination is not an applicable aging effect at CR-3.

The applicant has identified through plant walkdowns that corrosion and oxidation is an applicable aging effect at CR-3. The staff reviewed the applicant's Fuse Holder Program and its evaluation is documented in SER Section 3.0.3.2.15. The staff finds the applicant's proposed AMP acceptable because this AMP will detect the corrosion and oxidation of fuse holders using thermography and/or resistance measurement. The testing of the fuse holders is consistent with that in GALL AMP XI.E5.

In LRA, Table 3.6.2-1, under Non-EQ Electrical/I&C Penetration Assemblies, the applicant indicated that there is no aging effect requiring management for non-EQ electrical/I&C penetration assemblies XLPO, SR, Kapton, CSPE, EPR, Kynar material installed in an adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen. The applicant included note J indicating that neither the component nor the material and environment combination is evaluated in the GALL Report. In addition, the applicant provided Note 604 for this aging management review. In note 604, the applicant stated that evaluation has shown that the insulation materials for this commodity group are aptly suited for their service condition and acceptable for the period of extended operation. The applicant did not provide technical justification of why the insulation material of non-EQ electrical/I&C penetration assemblies are not subject to aging degradation. In a letter dated September 30, 2009, the staff issued RAI 3.6-3 requesting the applicant to explain why insulation material of non-EQ electrical/I&C penetrations is not subject to aging degradation.

In response to the staff's request, in a letter dated December 3, 2009, the applicant stated that the penetrations' primary insulation materials are essentially cable conductor insulation materials. The primary insulation materials for the non-EQ penetration assemblies, subject to AMR, are identical to the penetration assemblies in the EQ program in both composition and function. All penetration assemblies subject to an AMR are located in the Intermediate and Reactor Buildings. The applicant also stated that all penetration assemblies in the EQ program are qualified by test for the worst-case DBE condition in the Intermediate and Reactor Buildings. The non-EQ penetration assemblies subject to AMR are not required to remain functional during or following a DBE. The applicant further stated that penetration assemblies in the EQ Program are qualified for post-accident operation and the EQ test profile envelope the (non-accident) temperature and radiation environment in both the Intermediate and Reactor Buildings. Therefore, the applicant stated that because the non-EQ penetration assemblies are not required to remain functional during or following a DBE, and their insulation materials have been tested to the worst case DBE conditions in the Intermediate and Reactor Buildings, the insulation materials for the non-EQ penetration assemblies are acceptable for 60-year service. The applicant further stated that penetration assembly pigtails available for visual inspection are covered under the GALL Report, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

The staff reviewed the applicant's response and questioned the applicant's technical justification for why the insulation material of non-EQ electrical penetration is not subject to aging degradation. For cable conductor insulation materials inside non-EQ containment penetration assemblies, the applicant has not explained why the insulation material is adequate for 60-year service and not subject to aging requiring management. In a letter dated February 2, 2010, the staff issued RAI B.3.6-3.1 which requested that the applicant provide additional technical justification of why these materials are not subject to aging degradation.

In response to the staff's request, in a letter dated March 3, 2010, the applicant stated that the conductor insulating materials for the non-EQ containment penetration assemblies consist of XLPO, used in heat sink applications, SR, used for insulating boots, and Kapton, used as conductor insulation. A 60-year service limiting environment is the environment to which an insulation material can be exposed for 60 years and still perform its design function. The applicant also stated that these criteria are based on the aging properties of the insulation materials as they relate to the applicable stressors of heat and radiation. The applicant further stated that 60-year service-limiting environments for the conductor insulating materials are shown in the table below.

Insulation Material	Bounding 60-year Service-Limiting Environment	
	Temperature	Dose (rads)
XLPO	188 °F (86.6 °C)	1×10^8
SR	273 °F (133.9 °C)	3×10^6
Kapton	266 °F (130.2 °C)	2×10^8

The applicant further stated that the worst-case, normal operating environment on either the inboard side (i.e., the RB side) or outboard side (i.e., the Intermediate Building side) of the penetration assembly is 140 °F (60 °C) and 1.43×10^6 rads (60-year dose). The applicant stated that examination of the table above shows that the conductor insulation materials are bounded for the service conditions of the non-EQ containment penetration assemblies. Because these insulation materials are aptly suited for 60-year service, no AMP is required. Furthermore, the applicant stated that the similar cable insulating materials are installed in the RB and will be subject to the GALL AMP XI.E1. The inspections associated with GALL AMP XI.E1 provide reasonable assurance of the continued functionality of the cables internal to the electrical penetrations. The applicant also stated that the pressure boundary function of the non-EQ containment penetration is managed by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs.

The staff reviewed the applicant's response and finds it acceptable. Based on the information provided by the applicant, the staff determined that worst-case operating environment of the penetration assemblies are bounded by the 60-year service operating environment. Therefore, no aging management is required for insulation material inside of the non-EQ containment penetration. This program will provide reasonable assurance that the function of the cable insulation outside of the electrical penetration is maintained. Therefore, the staff's concern in RAI 3.6-3 is resolved. Based on the LRA and the applicant's response to RAI 3.6-3, the staff finds the applicant's proposed aging management acceptable.

In LRA, Table 3.6.2-1, under Non-EQ Electrical/I&C Penetration Assembly Pigtail, the applicant indicated that it will manage the aging effect of containment penetration pigtails installed in an adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen with the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The applicant included note J which means that neither the component nor the material and environment combination is evaluated in the GALL Report. In addition, the applicant provided Note 605 which stated that the Electrical Cables and Connections Not Subject To 10 CFR 50.49 EQ Requirements Program is applicable to non-EQ Namco conduit seal assembly pigtails. The staff noted that the non-EQ containment penetration assembly pigtail is the same commodity type of insulation material for cables and connections in the GALL Report item VI.A-2. The material, environment, and the AMP of this AMR item are consistent with those in the GALL Report. Therefore, the staff finds that this item is consistent with that in the GALL Report, and no further evaluation is required.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the EIC system components, within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3, "Aging Management Review Results," and LRA Appendix B, "Aging Management Programs and Activities." On the basis of its review of the AMR results and AMPs, the staff concludes, pending resolution of open items OI-3.0.3.1.9-1, OI-3.0.3.1.10-1, OI-3.0.3.1.19-1, OI-3.0.3.2.10-1, OI-3.0.3.2.13-1, OI-3.0.3.2.14-1, OI-3.3.2.2.4.1-1, and OI-3.5-1 and confirmatory item CI-3.0.3.1.11-1, that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable FSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for aging management, as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), will be conducted in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 <u>Identification of Time-Limited Aging Analyses</u>

This section of the safety evaluation report (SER) addresses the identification of time-limited aging analyses (TLAAs). In license renewal application (LRA) Sections 4.2 through 4.7, Florida Power Corporation (FPC or the applicant) addressed the TLAAs for Crystal River Unit 3 Nuclear Generating Plant (CR-3). SER Sections 4.2 through 4.8 document the review of the TLAAs conducted by the staff of the United States Nuclear Regulatory Commission (NRC or the staff).

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), the applicant is required to list TLAAs as defined in 10 CFR 54.3, "Definitions."

In addition, in accordance with 10 CFR 54.21(c)(2), the applicant is required to list existing plant-specific exemptions granted under 10 CFR 50.12, "Specific Exemptions," that are based on TLAAs. For any such exemptions, the applicant must evaluate, and justify, the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for CR-3 against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the final safety analysis report (FSAR), technical specifications, engineering calculations, docketed licensing correspondence, design basis documents, and applicable vendor reports. In LRA Table 4.1-1, "Time-Limited Aging Analyses," the applicant listed the following applicable TLAAs:

- reactor vessel neutron embrittlement
- metal fatigue, including reactor coolant system loop piping leak-before-break analysis
- 10 CFR 50.49 thermal, radiation, and cyclical aging analyses
- tendon stress relaxation analysis
- fuel transfer tube expansion bellows cycles
- analysis of bedrock dissolution from groundwater

In accordance with 10 CFR 54.21(c)(2), the applicant stated in LRA Section 4.1.3 that it had identified one exemption granted under 10 CFR 50.12 that was based on a TLAA, as defined in 10 CFR 54.3. It is a partial exemption from the provisions to 10 CFR Part 50, Appendix A, General Design Criterion 4, to permit revision of the design of reactor coolant pump (RCP) supports. Specifically, the exemption permitted replacing 32 large bore piping snubbers with 4 smaller snubbers and 4 struts. The analysis used leak-before-break (LBB) technology that relies on fracture mechanics to demonstrate the capability to detect leakage well before any cracks in the pipe wall could become unstable and grow to failure. The fracture mechanics analysis is contained in report BAW-1847, "The B&W Owner's Group Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSSS," Revision 1.

4.1.2 Staff Evaluation

LRA Section 4.1 lists the CR-3 TLAAs. The staff reviewed the information to determine whether the applicant had provided sufficient information pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs meet the following six criteria:

(1) involve systems, structures, and components (SSCs) within the scope of license renewal, in accordance with 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the SSC to perform its intended functions, as described in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant reviewed the list of common TLAAs in NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005. The applicant listed TLAAs applicable to CR-3 in LRA Table 4.1-1.

Based on its review, the staff finds that the applicant has satisfied the requirements of 10 CFR 54.3 to identify the TLAAs that are applicable to the LRA because the applicant has satisfied the TLAA identification guidance and recommendations in SRP-LR Sections 4.2 through 4.7. The staff did not identify any omissions of TLAAs for this LRA. The staff confirmed that the TLAAs identified by the applicant as being applicable to the LRA have been evaluated by the applicant against the provisions and criteria of 10 CFR 54.21(c)(1). The staff's evaluations of these TLAAs are provided in SER Sections 4.2 through 4.7.

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, which are based on TLAAs, and are to be evaluated and justified for continuation through the period of extended operation. The LRA states in LRA Section 4.1.3 that each active exemption was reviewed to determine whether it was based on a TLAA. The applicant identified one TLAA-based exemption.

Based on the information provided by the applicant regarding the process used to identify these exemptions and its results, the staff concludes, in accordance with 10 CFR 54.21(c)(2), that the applicant identified one TLAA-based exemption and justified it for continuation through the period of extended operation.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff confirms, as required by 10 CFR 54.21(c)(2), that one exemption to 10 CFR 50.12 had been granted based on a TLAA.

4.2 Reactor Vessel Neutron Embrittlement

The regulations that govern reactor vessel (RV) integrity are provided in the following sections of 10 CFR Part 50:

- Section 50.60 requires all light-water reactors to meet 10 CFR Part 50, Appendices G and H regarding fracture toughness, pressure-temperature (P-T) limits, and material surveillance program requirements for the reactor coolant boundary.
- Section 50.61 provides fracture toughness requirements for protection against pressurized thermal shock (PTS).

Neutron embrittlement describes changes in mechanical properties of RV materials in the vicinity of the reactor core beltline region (i.e., the region defined by the upper and lower active core planes). The metric of neutron exposure is neutron fluence (i.e., the time integral of neutron flux with energies greater than 1.0 million electron volts (MeV)). The most pronounced material change, relevant to this case, is reduction in fracture toughness with increasing neutron fluence. As fracture toughness decreases with cumulative fast neutron exposure, the material's resistance to crack propagation decreases. Fracture toughness of ferritic materials depends upon temperature. The reference temperature for nil-ductility transition (RT_{NDT}) is the transition temperature above which the material is ductile and below which it is brittle. As neutron fluence increases, the RT_{NDT} increases and higher temperatures are required for the material to remain ductile. This shift in reference temperature is denoted as adjusted reference temperature (ART) and is evaluated for each beltline material as shown in the equation below:

$$ART = RT_{NDT(u)} + \Delta RT_{NDT} + M$$

where:
$RT_{NDT(u)}$ is the unirradiated RT_{NDT}
ΔRT_{NDT} is the shift in RT_{NDT} caused by neutron irradiation
M is a margin term to account for uncertainties in the values of initial RT_{NDT}, copper and nickel contents, neutron fluence, and calculation procedures

Determination of the projected RV reduction in fracture toughness as a function of neutron fluence affects several analyses that support CR-3 operations:

- reactor vessel adjusted reference temperature
- reactor vessel material upper-shelf energy
- reactor vessel pressurized thermal shock
- pressure-temperature limits

As extension of the operating period from 40 years to 60 years will increase neutron fluence, the 60-year neutron fluence value and its impact upon the analyses that support operation must be determined. The approach taken by the applicant was to determine first if the existing analysis could be demonstrated to remain valid. If not, then the applicant prepared a new analysis. If the new analysis was not acceptable, then the applicant decided to manage the aging effect identified within the TLAA during the period of extended operation.

4.2.1 Reactor Vessel Fluence

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 summarizes the evaluation of RV fluence for the period of extended operation, projecting neutron exposure levels for the reactor pressure vessels for an operating period extending to 54 effective full-power years (EFPY), as provided in LRA Table 4.2-1 for each RV location.

The applicant stated that CR-3 fluence calculations supporting the period of extended operation were performed using staff-approved methods. The applicant stated that the RV neutron fluence calculations were performed in accordance with the methodology described by AREVA NP licensing topical report BAW-2241NP-A, Revision 1, “Fluence and Uncertainty Methodologies.” Furthermore, the applicant stated that the CR-3-specific fluence calculations were performed in a manner that was consistent with the guidance contained in Regulatory Guide (RG) 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence,” and to the conditions and limitations set forth in the staff’s safety evaluation approving BAW-2241NP-A.

The applicant stated that the historic capacity factor at CR-3 has been 68.2, which includes operation through 2005. Assuming a plant capacity factor of 98.5 percent from 2005 through the period of extended operation, the applicant stated that the plant would accrue 50.3 EFPY of exposure.

The applicant stated that fluence values through 54 EFPY include ex-vessel cavity dosimetry data from Cycles 11 and 12 and plant operation through Cycle 14. The applicant further stated that the Cycle 15 neutron fluxes were assumed to be the same as those for Cycle 14. For Cycles 16 and 17, the applicant increased the neutron flux for Cycle 14 by a factor of 1.02 to account for the implementation of a measurement uncertainty recapture (MUR) power uprate. For Cycle 18 through the period of extended operation, the neutron fluxes were the Cycle 16 and 17 neutron fluxes increased by an additional factor of 1.25.

The applicant dispositioned this TLAA based on the criterion in 10 CFR 54.21(c)(1)(ii).

4.2.1.2 Staff Evaluation

The staff reviewed LRA Section 4.2.1 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the neutron fluence analyses have been projected to the end of the period of extended operation.

The staff performed its review to establish that the RV neutron fluence calculations were performed in a manner consistent with RG 1.190 and, hence, are acceptable to the staff, and the calculations are consistent with past, current, and planned facility operation.

The applicant stated that the calculations were performed as described by BAW-2241NP-A. The staff audited the applicant's calculations and confirmed that the calculations were consistent with the methodology described in BAW-2241NP-A. As concluded in the staff's safety evaluation approving BAW-2241NP-A, this method adheres to the guidance contained in RG 1.190, is suitably benchmarked for calculations in Babcock and Wilcox (B&W) reactors such as CR-3, and is, hence, acceptable to the staff.

The applicant stated that fluence calculations, that were performed, were verified using cavity dosimetry and accounted for past operation through Cycle 14. While Cycle 15 neutron fluence was based on the same peripheral flux as Cycle 14, ongoing cycles relied on increased flux projections to account for the implementation of an MUR power uprate. These statements indicate that the applicant's fluence calculations account for past operating history and include additional margin to account for the effects of the uprate, thus accounting for past and present operation.

The applicant also stated that, assuming a capacity factor of 98.5 percent from 2005 through the period of extended operation, the plant would accrue a neutron fluence equivalent to 50.3 EFPY. Therefore, the 54 EFPY fluence projections will bound expected plant operation through the period of extended operation. The staff reviewed recent capacity factors for CR-3 in NUREG-1350, Volume 21, "2009–2010 Information Digest," and determined that the average capacity factor did not exceed 95 percent based on an average of the years from 2003 through 2008. Therefore, the staff concludes that the assumption of a 98.5-percent capacity factor is conservative and 54 EFPY fluence projections are acceptable to cover the period of extended operation for CR-3.

The staff noted that previous RV neutron fluence calculations by the applicant account for the MUR uprate by increasing the neutron fluxes by as much as 7 percent, whereas the current flux estimate is increased by 2 percent. In light of this difference, the staff issued request for additional information (RAI) 4.2-1, dated August 31, 2009, requesting that the applicant clarify the apparent reduction in conservatism by justifying the acceptability of the 2 percent multiplier in the current calculations.

The applicant's September 30, 2009, response stated that the previous fluence calculations included a 2 percent margin to account for the power uprate and a 5 percent margin to account for a planned downcomer water temperature increase. The modification resulting in an increase in downcomer water temperature, however, was not implemented. The applicant concluded, therefore, that the additional 5 percent margin was unnecessary. The staff finds this clarification acceptable because it demonstrates that the flux multiplier is appropriate for current facility operation.

Because the fluence calculation methodology is NRC-approved and adheres to RG 1.190, and the fluences have been appropriately projected to the end of the period of extended operation, the staff finds the calculated fluences in LRA Table 4.2-1 acceptable.

4.2.1.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RV neutron fluence in LRA Section A.1.2.1.1. Based on its review of the FSAR supplement consistent with the guidance of SRP-LR Section 4.2.3.2, the staff concludes that the summary description of the applicant's actions to address RV neutron fluence is adequate.

4.2.1.4 Conclusion

The staff finds that the applicant's fluence calculations are acceptable to support the period of extended operation for CR-3. The staff's finding is based on the fluence calculations that are performed using staff-approved methods in accordance with RG 1.190 and that the fluence calculations account acceptably for past, present, and planned facility operation.

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that the RV neutron fluence analyses have been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.2 Upper-Shelf Energy Analysis

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 summarizes the evaluation of Charpy upper-shelf energy (C_VUSE) for the period of extended operation. Fracture toughness is a measure of a material's resistance to crack propagation. Charpy V-notch tests indirectly estimate fracture toughness, and Charpy V-notch test results are measured in foot-pound (ft-lb) of absorbed energy. The more ductile a material, the higher the fracture toughness and the more ft-lb of energy will be absorbed during the Charpy V-notch test. The fracture toughness of RV steels is temperature-dependent. At low temperatures, the vessel material toughness is relatively low and the material behaves in a brittle fashion. With increasing temperature, the toughness increases to a point where the toughness increase is rapid, until an upper-shelf plateau where the toughness is higher and constant. In this higher toughness region, the material is ductile. These regions of the curve are the lower shelf, transition zone, and upper shelf, respectively. Appendix G to 10 CFR Part 50 contains screening criteria that limit the level to which the upper-shelf energy (USE) value for an RV material may be allowed to drop due to neutron radiation exposure. The regulation requires the initial RV material USE to be equal to or above 75 ft-lbs and for the USE to be equal to or above 50 ft-lbs throughout the licensed life of the vessel, unless lower values of USE can be demonstrated to provide margins of safety against fracture equivalent to those required by Appendix G of the American Society of Mechanical Engineers (ASME) Code Section XI. The applicant used Position 1.2 of RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," to determine the percent drop in C_VUSE for each of the CR-3 RV materials.

The applicant dispositioned this TLAA on USE analysis for all RV beltline materials based on the criterion in 10 CFR 54.21(c)(1)(ii).

Upper-Shelf Energy for Beltline Plates and Forgings. The LRA describes that an analysis of the USE of the CR-3's RV beltline plate and forging materials for the period of extended operation (54 EFPY) requires the use of RG 1.99, Revision 2. The application further states that the RV USE analyses were determined at the 1/4T wall location (i.e., the location one-fourth through the RV wall thickness from the inner surface) of each beltline material using the respective copper contents, projected neutron fluences, and RG 1.99, Revision 2. From the RV USE analyses provided in LRA Table 4.2-2, the applicant concluded that the CR-3 RV beltline plates and forgings remain above the 50 ft-lb limit of Appendix G to 10 CFR Part 50.

Upper-Shelf Energy for Beltline Welds. The LRA states that the CR-3 RV beltline welds have projected USE less than 50 ft-lbs and, therefore, equivalent margins analyses (EMAs) have been performed to demonstrate the acceptability of the welds through 54 EFPY, in accordance with Appendix G of the ASME Code Section XI. The applicant stated that the methodology used to evaluate the CR-3 beltline welds at 60 years is consistent with the EMA methods reported in BAW-2192PA, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of B&W Owners Reactor Vessel Working Group for Level A & B Service Loads;" BAW-2178PA, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of Reactor Vessels of B&W Owners Reactor Vessel Working Group for Level C & D Service Loads;" and BAW-2275A, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of B&W Designed Reactor Vessels for 48 EFPY." All of these reports were previously approved by the NRC. The analysis of BAW-2275A was updated for the CR-3 limiting beltline welds WF-70, WF-8, and WF-18 to determine the associated fracture toughness properties after 60 years of operation (54 EFPY).

The updated EMA considered the effect of the increased neutron fluence on the material J-integral resistance (J_R), a material property that is a function of neutron fluence and copper content. The EMA acceptance criterion from Appendix K of the ASME Code for J at Level A and B service loadings is based on a ductile flaw extension of 0.1 inch and is satisfied when $J_1 < J_{0.1}$ (where $J_{0.1}$ equals the material J_R that will result in a ductile flaw extension of 0.1 inch and J_1 equals the applied J-integral with a safety factor of 1.15 on pressure and a safety factor of 1.0 on thermal loading). LRA Table 4.2-3 provides the results of the EMA for Level A and B service loads. LRA Table 4.2-4 contains the EMA for Level C and D service loads. The applicant concluded that the analyses demonstrate that the RV beltline welds satisfy the acceptance criteria of the ASME Code Section XI, Appendix K and, therefore, provide margins of safety against fracture equivalent to those required by Appendix G of ASME Code Section XI. Therefore, the applicant concludes that the CR-3 RV beltline weld materials have adequate upper-shelf toughness and satisfy the requirements of Appendix G to 10 CFR Part 50, Section IV.A.1.a, through 54 EFPY.

4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 to verify that the analysis has been projected to the end of the period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii). Section IV.A.1 to 10 CFR Part 50, Appendix G requires RV beltline materials to have USE values equal to or above 75 ft-lbs when the materials are in the unirradiated condition and equal to or above 50 ft-lbs throughout the licensed life of the RV. RG 1.99, Revision 2 provides an approved methodology regarding the calculations of USE values and describes two methods for determining USE values for RV beltline materials, depending on whether or not a given RV beltline material is represented in the plant's Reactor Vessel Surveillance Program.

The applicant provided its USE analyses for the CR-3 RV beltline materials in LRA Table 4.2-2. The USE analyses were based on the 1/4T neutron fluence values listed in LRA Table 4.2-1 and these neutron fluence values were based on the projected values at the end of the period of extended operation (i.e., at 54 EFPY), which the staff found acceptable in SER Section 4.2.1.

Upper-Shelf Energy for Beltline Plates and Forgings. The staff performed independent calculations of the USE values for the RV beltline plate and forging materials through the period of extended operation. The staff applied the methods provided in RG 1.99, Revision 2 for performing the independent USE calculations. The staff determined that for the CR-3 plates and forgings, upper shell plate C4344-1 is the limiting material and all plates and forging materials have projected USE values above the 50 ft-lb limit at 54 EFPY. The staff calculated a USE value of 65 ft-lbs for the CR-3 upper shell plate at 54 EFPY and this value is in close agreement with the value calculated by the applicant. This value meets the acceptance criterion in 10 CFR Part 50, Appendix G for maintaining the USE values of the RV beltline materials above 50 ft-lbs throughout the licensed life of the plant. Therefore, since the bounding plate and forging material for the CR-3 RV meets the requirements of 10 CFR Part 50, Appendix G, all of the CR-3 RV beltline plate and forging materials will continue to meet the applicable regulatory requirements for USE for the period of extended operation.

Upper-Shelf Energy for Beltline Welds. For the beltline welds, the applicant relied on topical report BAW-2275A. This report addressed the issue of low-upper-shelf fracture toughness for Linde 80 welds in B&W vessels for an extended license period of 48 EFPY. The staff previously reviewed BAW-2275A using the calculational procedures and evaluation criteria of Appendix K of the ASME Code and approved the report (Agencywide Documents Access and Management System (ADAMS) Accession No. ML0036702807).

The staff issued RAI 4.2.2-1, by letter dated August 3, 2010, requesting additional information regarding the analysis of USE for the CR-3 RV beltline welds. Specifically, RAI 4.2.2-1 requested that the applicant provide a technical basis for the application of BAW-2275A to include the CR-3 vessel materials (CR-3 was not one of the plants included in the BAW-2275A analyses) and an extended license period of 54 EFPY, as opposed to the 48 EFPY of BAW-2275A.

In its September 11, 2010, response, the applicant submitted AREVA NP topical report ANP-10308, "Low Upper-Shelf Toughness Fracture Mechanics Analysis of the Crystal River Unit 3 Reactor Vessel for 54 EFPY," to demonstrate that the welds of the CR-3 RV beltline satisfy the acceptance criteria of Appendix K of ASME Code Section XI and, therefore, provide margins of safety equivalent to those of Appendix G of ASME Code Section XI. C_VUSE values for CR-3 at 54 and 48 EFPY were determined and an EMA was performed for the CR-3 RV weld materials.

The staff reviewed the effect of the increased neutron fluence values, from 48 EFPY to 54 EFPY, on the material J_R. The material property, J_R, is a function of neutron fluence and copper content. Copper contents of the CR-3 limiting materials did not change from BAW-2275A. The staff confirmed that welds WF-18 and WF-8 satisfy the requirement of $J_1 < J_{0.1}$ for Level A and B service loadings and that all $J_{0.1}/J_1$ ratios remain greater than the acceptance criterion of 1. For Level C and D service loads, the staff confirmed that the applied J-integral is less than the J-integral of the material at a ductile flaw extension of 0.1 inch by a margin of 2.26, well above the acceptance criteria of 1.15.

In topical report ANP-10308, the calculation of the J-integral at 54 EFPY showed that weld SA-1526 at Three Mile Island, Unit 1 (TMI-1) at 48 EFPY continued to be limiting among the weld materials analyzed in BAW-2275A. Since the CR-3 beltline weld materials are bounded by TMI-1 weld SA-1526, it can, therefore, be concluded that the CR-3 beltline welds have adequate upper-shelf toughness and satisfy the requirements of Appendix G to 10 CFR Part 50 at 54 EFPY. Therefore, for 54 EFPY, the conclusions reported in BAW-2275A remain valid regarding the evaluation of Level C service loads relative to J_R and $J_{applied}$ and to Level C and D service loads relative to ductile and stable flaw extension. The analysis and conclusions demonstrate that the CR-3 RV beltline welds satisfy the acceptance criteria of the ASME Code Section XI, Appendix K and, therefore, provide margins of safety against fracture equivalent to those required by Appendix G of ASME Code Section XI. Therefore, the staff concludes CR-3 RV beltline welds have adequate upper-shelf toughness and satisfy the requirements of Appendix G to 10 CFR Part 50, Section IV.A.1.a at 54 EFPY, and the concerns identified in RAI 4.2.2-1 are resolved. Further, the beltline weld materials for the CR-3 RV will continue to meet the applicable regulatory requirements for USE for the period of extended operation.

4.2.2.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of C_VUSE in LRA Section A.1.2.1.2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.2.3.2, the staff concludes that the summary description of the applicant's actions to address C_VUSE is adequate.

4.2.2.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.2.3.1.1, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analysis for CR-3 RV beltline materials has been projected to the end of the period of extended operation.

4.2.3 Pressurized Thermal Shock Analysis

To provide protection against pressurized thermal shock (PTS) events, 10 CFR 50.61 defines screening criteria for the embrittlement of RV materials in pressurized water reactors (PWRs), as well as actions required if these screening criteria are exceeded. The RV reference temperature for PTS (RT_{PTS}) will increase due to increasing neutron fluence, and the screening criteria specify limits on the RT_{PTS} values. RT_{PTS} values are calculated for each beltline material using:

$$RT_{PTS} = RT_{NDT(u)} + \Delta RT_{PTS} + M$$

where:
$RT_{NDT(u)}$ is the unirradiated RT_{NDT}
ΔRT_{PTS} is the shift in RT_{NDT} caused by neutron irradiation
M is a margin term to account for uncertainties in the values of initial RT_{NDT}, copper and nickel contents, neutron fluence, and calculation procedures

The rule requires the RT_{PTS} values for all beltline materials to be maintained below the PTS screening criteria throughout the period of extended operation. For circumferential welds, the PTS screening criterion is 300 °F. For plates, forgings, and axial welds, the PTS screening criterion is 270 °F.

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 summarizes the evaluation of CR-3's PTS analysis for the period of extended operation, performed in accordance with 10 CFR 50.61.

The LRA states that evaluations of the RT_{PTS} values for each RV beltline material were based on the tabulated chemistry factor values given in 10 CFR 50.61. Additionally, the LRA states that the chemistry factor for upper shell plate C4344-1 was recalculated using the available CR-3 surveillance data in accordance with RG 1.99, Revision 2. The CR-3 RT_{PTS} values at 54 EFPY for the beltline materials were provided in LRA Table 4.2-5. The LRA identifies that the limiting longitudinal welds were WF-8 and WF-18, with an RT_{PTS} of 231.3 °F, which is below the screening criterion of 270 °F for plates, forgings, and axial weld materials. The LRA identifies that the limiting circumferential weld is WF-70, with an RT_{PTS} of 253.8 °F, which is below the screening criterion of 300 °F for circumferential weld materials.

The applicant dispositioned this TLAA based on the criterion in 10 CFR 54.21(c)(1)(ii).

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis has been projected to the end of the period of extended operation.

The applicant provided its RT_{PTS} value assessments for the CR-3 RV beltline materials in LRA Table 4.2-5. The RT_{PTS} values listed in these tables were based on the neutron fluence values at the inside wetted surface of the RV. According to Table IV A-2 of the GALL Report, ferritic materials are subject to neutron embrittlement when they are exposed to a neutron fluence greater than 1×10^{17} neutrons per square centimeter (n/cm^2) with an energy level exceeding 1 MeV ($E > 1$ MeV) at the end of the period of extended operation. The applicant's neutron fluence values used to determine the RT_{PTS} values were based on the values that were projected to the end of the period of extended operation (i.e., at 54 EFPY), as found acceptable by the staff in SER Section 4.2.1.

To verify the validity of the applicant's calculation of the RT_{PTS} values at 54 EFPY for CR-3's limiting beltline materials, the staff performed independent calculations per 10 CFR 50.61 and found the RT_{PTS} values acceptable. The staff confirmed that circumferential weld WF-70 was the limiting circumferential weld beltline material, and longitudinal welds WF-8 and WF-18 were limiting for the plate, forging, and axial weld RV materials for CR-3. The staff calculated an RT_{PTS} value of 231.2°F for CR-3 longitudinal welds WF-8 and WF-18, which is in close agreement with the applicant's calculation of 231.3°F and is below the screening limit of 270°F for plates, forgings, and axial weld materials. The staff calculated an RT_{PTS} value of 253.8°F for CR-3 circumferential weld WF-70, which is in agreement with the applicant's calculation of 253.8°F and is below the screening limit of 300°F for circumferential weld materials. The staff finds the RT_{PTS} values for all CR-3 RV beltline materials to be acceptable because the bounding materials comply with the requirements specified in 10 CFR 50.61.

4.2.3.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of PTS in LRA Section A.1.2.1.3. Based on its review of the FSAR supplement consistent with

SRP-LR Section 4.2.3.2, the staff concludes that the summary description of the applicant's actions to address PTS is adequate.

4.2.3.4 Conclusion

Based on the technical assessments stated above, the staff concludes that the CR-3 RV beltline materials will maintain acceptable RT_{PTS} values throughout the period of extended operation. The staff, therefore, concludes that the applicant's TLAA for PTS, as given in LRA Section 4.2.3, is in compliance with the screening criteria specified in 10 CFR 50.61. Therefore, the staff concludes that the CR-3 RV will be acceptable for PTS through the expiration of the extended period of operation.

On the basis of its review consistent with SRP-LR Section 4.2.3.1.2, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the CR-3 RV PTS analysis has been projected to the end of the period of extended operation.

4.2.4 Operating Pressure-Temperature Limits

In accordance with 10 CFR Part 50, Appendix G, P-T operating limits are specifically required for three categories of operation: (1) hydrostatic pressure tests and leak tests, (2) non-nuclear heatup/cooldown and low level physics tests, and (3) core critical operation. The P-T limits must be at least as conservative as limits obtained by the methods of analysis and margins of safety of Appendix G of the ASME Code Section XI. The ART values of the limiting beltline material(s) at locations one-fourth of the wall thickness from the vessel inner surface and outer surface (e.g., 1/4T and 3/4T) are used to adjust the RV beltline P-T limits to account for radiation effects. The minimum temperature requirements in Appendix G pertain to the limiting material, which is either the highly stressed material in the closure flange region or a material in the beltline region with the highest ART value.

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 summarizes the evaluation of material ART values and operating P-T limits analysis for the period of extended operation. This section states that the ART values for the CR-3 RV beltline materials were calculated in accordance with RG 1.99, Revision 2. The ART values projected to 54 EFPY are contained in LRA Table 4.2-6. As with the PTS analyses, the LRA states that evaluations of the ART values for each RV beltline material were based on the tabulated chemistry factor values given in RG 1.99, Revision 2 and on the copper and nickel content of each material, and, additionally, the chemistry factor for upper shell plate C4344-1 was recalculated using the available CR-3 surveillance data in accordance with RG 1.99, Revision 2.

The LRA states that the P-T operating limits were developed in accordance with the requirements of 10 CFR Part 50, Appendix G using the analytical methods and flaw acceptance criteria of topical report BAW-10046A, "Methods of Compliance with Fracture Toughness and Operational Requirements of 10 CFR 50, Appendix G," Revision 2 and ASME Code Section XI, Appendix G, 2001 Edition through 2003 Addenda. The applicant stated that it has implemented changes in the P-T limit curves throughout the current operating period.

The LRA states that the CR-3 technical specifications refer to P-T limit curves in the CR-3 Pressure-Temperature Limits Report (PTLR). The applicant further stated that, although it has calculated P-T curves for the period of extended operation, it will not implement the curves at this time but will retain the current P-T curves, which are valid through 32 EFPY. CR-3 will continue to implement changes to the P-T curves in the PTLR, as required by 10 CFR Part 50, Appendix G, for the current and extended periods of operation, using approved fluence calculations when there are changes in power or core design and surveillance capsule results.

The applicant dispositioned this TLAA in accordance with criterion 10 CFR 54.21(c)(1)(iii).

4.2.4.2 Staff Evaluation

P-T limit curves are provided to specify the maximum allowable pressure as a function of reactor coolant temperature in order to prevent or minimize the effects of reduced fracture toughness caused by neutron irradiation. The curves are generated assuming that a 1/4T surface flaw exists using the fracture mechanics methodology in ASME Code Section XI, Appendix G. The P-T limit curves are not provided for the detection of aging effects, but rather to prevent or minimize the effects of reduced fracture toughness caused by neutron irradiation. The P-T limit curves are valid for a specified number of EFPY. The curves must be updated before this time period is exceeded. This approach is acceptable since the validity of the curves is monitored and the P-T limit curves are updated prior to exceeding the applicable EFPY.

The staff reviewed LRA Section 4.2.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The current CR-3 P-T limit curves are valid to 32 EFPY in the CR-3 PTLR. The applicant stated that it will continue to revise the P-T limit curves in the PTLR for the remainder of the current and extended periods of operation, as necessary. The P-T limit curves will be revised to reflect updated neutron fluence calculations resulting from changes in power or core design and with surveillance capsule results. Updates to the P-T limit curves will use the approach contained in the PTLR. The Reactor Vessel Surveillance Program is in place to monitor RV embrittlement. This program will provide data to update P-T limits and, therefore, will permit the applicant to manage P-T limits going forward.

The staff finds this approach acceptable, in accordance with 10 CFR 54.21(c)(1)(iii), because the applicant will manage the effects of aging on the P-T limits consistent with methods acceptable to the staff.

4.2.4.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of P-T limits in LRA Section A.1.2.1.4. On the basis of its review of the FSAR supplement consistent with SRP-LR Section 4.2.3.2, the staff concludes that the summary description of the applicant's actions to operating P-T limits is adequate.

4.2.4.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.2.3.1.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that for operating P-T limits, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Low-Temperature Overpressure Protection Limits

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 summarizes the evaluation of low-temperature overpressure protection (LTOP) limits for the period of extended operation. The LRA states that ASME Code Section XI, Appendix G establishes procedures and limits for reactor coolant system (RCS) pressure and temperature conditions to provide protection against non-ductile failure of the RV, and that the low temperature overpressure protection system assures that the limits are not exceeded when it is enabled at low temperatures. The LRA further states that the LTOP limits have been reanalyzed to support operation to the end of the period of extended operation for CR-3, using the fluence projections from LRA Section 4.2.1 and available surveillance data. Further, the LRA states that the revised LTOP setpoints will be implemented prior to exceeding 32 EFPY.

The applicant dispositioned this TLAA in accordance with criterion 10 CFR 54.21(c)(1)(iii).

4.2.5.2 Staff Evaluation

The staff reviewed LRA Section 4.2.5 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The current CR-3 LTOP setpoints are valid to 32 EFPY. The LRA states that the revised LTOP septpoints will be implemented when the revised P-T limit curves are implemented, prior to exceeding 32 EFPY. The LTOP setpoint analysis included the fluence projections from LRA Section 4.2.1 and available surveillance data.

The staff finds the applicant's management approach acceptable because the effects of aging will be appropriately accounted for in the LTOP setpoints in accordance with Appendix G to 10 CFR Part 50 and 10 CFR 50.60, in accordance with 10 CFR Part 54(c)(1)(iii).

4.2.5.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of LTOP setpoints in LRA Section A.1.2.1.5. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.7.3.2, the staff concludes that the summary description of the applicant's actions to address LTOP setpoints is adequate.

4.2.5.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.7, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that for LTOP setpoints, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.6 Reactor Vessel Underclad Cracking

RV underclad cracking (UCC) was first detected in 1970 at Nucleoelectrina Argentina SA's Atucha 1 RV. An extensive investigation was conducted by B&W following the discovery, and it was determined that UCC is present only in A 508, Class 2 forgings manufactured to a coarse grain practice and clad by high heat input submerged arc processes (such as six wire, strip, and two wire series arc). No anomalies were noted in SA 533 Grade B, Class 1 plate materials clad by any of the high heat input processes.

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 states that a fracture mechanics analysis was conducted and reported in BAW-10013-A, "Study of Intergranular Separations in Low-Alloy Steel Heat Affected Zones under Austenitic Stainless Steel Weld Cladding," October 1972. This analysis indicated that a critical crack size was required to initiate fast fracture and that this size is several orders of magnitude greater than the assumed maximum flaw size plus predicted growth due to design fatigue cycles.

The LRA states that a revised fracture mechanics analysis for UCC was presented in BAW-2274-A, "Fracture Mechanics Analysis of Postulated Underclad Cracks in B&W Designed Reactor Vessels for the Period of Extended Operation," August 1999, to include the period of extended operation. The revised analysis concluded that the postulated UCC in the RV met the acceptance criteria of the ASME Code Section XI, IWB-3612. The LRA states that the CR-3 RV was not specifically listed as a participant in the BAW-2274-A report, but the report should bound the CR-3 components since the report used bounding loads for B&W plants.

To confirm that CR-3 is bounded by BAW-2274-A, the LRA addresses the loads and material properties of CR-3 relative to those used in BAW-2274-A. The LRA states that the loads at CR-3 are bounded by BAW-2274-A, and three vessel regions were evaluated to confirm that the CR-3 material properties were also bounded by those used in the report. These areas were the nozzle belt, the closure flange, and the beltline. The LRA states that the results of the evaluation indicated that CR-3 is bounded by the results of BAW-2274-A and/or the methods and limits contained therein for generic evaluation.

Nozzle Belt. The LRA states that the ART for the CR-3 lower nozzle belt forging AZJ 94 is higher than the material properties used in BAW-2274-A. Thus, the analysis was re-evaluated for this forging for 54 EFPY. The LRA states that the analysis indicated that AZJ 94 at 54 EFPY would still have sufficient fracture toughness margin for ASME Code Service Levels A through D loadings using a postulated 0.353-inch deep flaw on the inside nozzle surface. The LRA concludes that this forging would, therefore, satisfy the flaw acceptance criteria of the ASME Code for 54 EFPY of operation over the period of extended operation.

Closure Flange. The LRA states that the closure flange remains bounded by the results of BAW-2274-A at 54 EFPY as the 54 EFPY fluence for the CR-3 closure flange is 4.38×10^{13} n/cm^2 (E > 1 MeV), while the bounding value for the BAW-2274-A analysis was 7.78×10^{16} n/cm^2 (E > 1 MeV).

Beltline (Upper and Lower Shells). The LRA states that the beltline upper and lower shells were fabricated from SA-533 Grade B, Class 1 material and are not susceptible to UCC. The LRA concludes, therefore, that this issue does not apply to CR-3.

The applicant dispositioned this TLAA in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 4.2.6, to verify that the RV UCC analyses have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The purpose of BAW-2274-A was to establish an acceptable method of meeting the requirements of 10 CFR 54.21(c)(1) and through reference, the ASME Code (specifically the flaw acceptance criteria) as a bounding analysis. The methods used in BAW-2274-A, and the conclusions that were drawn, were accepted for reference by the staff.

The staff reviewed BAW-2274-A and found that the material properties for the CR-3 RV were included in the analysis. As a result, BAW-2274-A was directly relevant to CR-3 and the analysis method could logically be extended to 54 EFPY. Because the ART of the CR-3 lower nozzle belt forging AZJ 94 was 3 °F higher than the limiting forging cited in the BAW-2274-A report, the staff issued RAI 4.2.6-1, by letter dated August 3, 2009, requesting that the applicant demonstrate that the reanalysis of the lower nozzle belt forging AZJ 94 is consistent with the methodology used in BAW-2274-A.

The applicant's September 11, 2009, response stated that the lower nozzle belt forging was re-evaluated as documented in AREVA NP document 32-9075768-000, "Evaluation of CR3 Nozzle Belt Forging for Underclad Cracking For License Renewal," using the methods in BAW-2274-A. This reanalysis demonstrated that this forging satisfies the relevant ASME Code fracture toughness margins for a postulated crack using 54 EFPY fluence levels. The relevant ASME Code fracture toughness margin requirements are given in ASME Code Section XI, IWB-3612, as ratios between the crack arrest fracture toughness and the maximum applied stress intensity factors in normal and upset conditions. This ratio represents the expected additional material strength of the welds under specified design basis loading conditions. The results of the re-evaluation found that the final flaw size was projected to be 0.487 inches and the lowest fracture toughness margin would be 3.49 for ASME Code Service Level A and B loadings, which is greater than the required margin of 3.16 ($\sqrt{10}$) specified in IWB-3612(a). The fracture toughness margin for Service Level C and D loadings was found to be 2.50, which exceeds the required value of 1.42 ($\sqrt{2}$) specified in IWB-3612(b). The staff found the calculations and results satisfactory. The staff concluded that the AZJ 94 forging meets the acceptance criteria of ASME Code Section XI, IWB-3612.

The staff confirmed that the closure flange was bounded by the analysis in BAW-2274-A and is, therefore, acceptable regarding UCC concerns. Since the beltline upper and lower shells are manufactured from SA-533 Grade B, Class 1 materials, which are not susceptible to UCC, the staff considers the beltline to be acceptable with regard to UCC concerns.

Based on the analysis provided by the applicant as described above, the staff concludes that the effects of aging on the TLAA related to RV UCC has been projected to the end of the period of extended operation.

4.2.6.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RV UCC in LRA Section A.1.2.1.6. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.7.3.2, the staff concludes that the summary description of the applicant's actions to address UCC is adequate.

4.2.6.4 Conclusion

Based on its review consistent with SRP-LR Section 4.7, the staff concludes that the applicant has demonstrated that the analyses for RV UCC have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.7 Reduction in Fracture Toughness of Reactor Vessel Internals

4.2.7.1 Summary of Technical Information in the Application

LRA Section 4.2.7 describes reduction of fracture toughness of reactor vessel internals (RVIs) as an aging effect caused by exposure to neutron irradiation. Exposure to neutron irradiation reduces fracture toughness of RVIs and is considered an aging effect. Prolonged exposure results in changes to the mechanical properties of the internals, including changes in tensile and yield strength concomitant with a reduction in ductility and fracture toughness. The extent of loss of fracture toughness is a function of both the irradiation temperature and neutron fluence and is more severe the closer the material is to the reactor core.

The LRA states that the effects of irradiation on mechanical properties and deformation limits for RVIs were evaluated for the current term in Appendix E of BAW-10008, Part 1, Revision 1, “Reactor Internals Stress and Deflection Due to Loss-of-Coolant Accident and Maximum Hypothetical Earthquake,” June 1970. The analysis concluded that the RVIs of CR-3 have adequate ductility to absorb local strain at the regions of maximum stress intensity and that irradiation will not change this.

In accordance with the guidance in the GALL Report regarding the aging management of RVI components, the applicant stated that it will:

- participate in the industry programs for investigating and managing aging effects on reactor internals
- evaluate and implement the results of the industry programs as applicable to the reactor internals
- upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for RVIs to the staff for review and approval

This commitment is documented in the FSAR supplement, as described in LRA Section A.1.2.1.7.

4.2.7.2 Staff Evaluation

The staff reviewed LRA Section 4.2.7 to verify that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

The requirements in 10 CFR 54.21(c)(1)(iii) state that the applicant shall demonstrate that, "[t]he effects of aging on the intended [functions] will be adequately managed for the period of extended operation."

To adequately manage aging of RVIs, Chapter IV, Section B4 of the GALL Report recommends a commitment to the following:

- participate in the industry programs for investigating and managing aging effects on RVIs
- evaluate and implement the results of the industry programs as applicable to the RVIs
- upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for RVIs to the staff for review and approval

The applicant committed to the three conditions stated above. This fulfills all requirements with regard to reduction in fracture toughness of internals.

4.2.7.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of fracture toughness of RVIs in LRA Section A.1.2.1.7. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.7.3, including the commitment discussed above, the staff concludes that the summary description of the applicant's actions to address fracture toughness due to neutron irradiation is adequate.

4.2.7.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.7, the staff concludes that the applicant has demonstrated that, for fracture toughness of the RVIs, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

LRA Section 4.3 states that several thermal and mechanical fatigue analyses of plant mechanical components have been identified as TLAAs, as discussed in subsequent subsections of the LRA:

- Fatigue Analyses (Nuclear Steam Supply System Components)
    - reactor vessel
    - reactor vessel internals
    - control rod drive mechanism
    - reactor coolant pumps

- steam generators
- pressurizer
- reactor coolant pressure boundary piping (USAS B31.7)

- Implicit Fatigue Analysis (B31.1 Piping)
  - USAS B31.1.0 Piping - Reactor Coolant Pressure Boundary Class 1
  - USAS B31.1.0 Piping - Non-Class 1
- Environmentally-Assisted Fatigue Analysis
- Reactor Coolant System Loop Piping Leak-Before-Break Analysis

The applicant stated the evaluation of components is used to demonstrate compliance with 10 CFR 54.21(c)(1) by using a combination of the methods of 54.21(c)(1)(i) for analyses that remain valid for the period of extended operation, 54.21(c)(1)(ii) for analyses that have been projected to the end of the period of extended operation, and 54.21(c)(1)(iii) for monitoring of design transients and managing the effects of aging for the period of extended operation.

4.3.1 Fatigue Analyses (Nuclear Steam Supply System Components)

Summary of Technical Information in the Application. LRA Section 4.3.1 states that the approach taken was to identify the latest design fatigue analyses associated with each nuclear steam supply system (NSSS) component within the reactor coolant pressure boundary (RCPB) in order to demonstrate that the design analyses will remain bounding through the period of extended operation. The applicant stated the components within the scope of this review include non-pressure boundary reactor internals components. The applicant stated the original fatigue design calculations assumed a large number of design transients corresponding to relatively severe system dynamics over the original 40-year design life and in general, the actual plant operations have resulted in only a fraction of the originally expected fatigue duty. The applicant further stated an assessment of the number of NSSS design transients that have occurred through December 2007 was compiled to determine the margin between the number of accrued cycles and the original 40-year design cycles.

The applicant stated the first step in the evaluation was to establish the current fatigue design bases for the major NSSS components by reviewing component design reports, amendments to those reports, and the assessment of the impact of the NRC-approved MUR 1.6-percent power uprate to identify the full set of NSSS design transients used in the fatigue evaluations. The applicant further stated that the governing NSSS design transients are those identified in FSAR Table 4-8, and listed in LRA Table 4.3-1, and cumulative usage factor (CUF) values were compiled from its component design documents and are presented in LRA Table 4.3-2.

The applicant stated the second step in the evaluation was to gather and review plant design information, actual plant transient data from the RCS and other sources, and archived RCS operational parametric data. The applicant used this information to develop actual operational transients experienced from plant startup through December 2007. The applicant stated that the transient data was obtained from its Cycle and Transient Monitoring Program, input from plant personnel, and historical data obtained from its records.

The applicant stated there is considerable margin after 30 years of operation to the NSSS design transient cycles originally defined for 40 years, and it has determined there is no need to increase the number of NSSS design transients for the period of extended operation. The applicant further stated that RCS CUFs may be conservatively projected to 60 years of operation by multiplying the 40-year CUFs by a factor of 1.5. The applicant has determined that 40-year usage factors in excess of 0.67 (i.e., 1.0/1.5) may be assumed to exceed the ASME Code Section III limit of 1.0 at 60 years. The applicant stated that this method of usage factor projection is conservative since it has determined that it is unlikely that the NSSS design transients for 40 years will be exceeded at 60 years of operation.

Staff Evaluation. In reviewing LRA Section 4.3.1, the staff identified several areas that required clarification and additional information for the staff to make its evaluation. The staff noted that the applicant stated that an assessment of the number of NSSS design transients that have occurred through December 2007 has been performed to determine the margin between the number of accrued cycles and the original 40-year design cycles. However, the staff noted that the applicant did not provide data referenced in its LRA as the "accrued cycles" through December 2007. In addition, the staff noted that the applicant did not provide discussion in its LRA of the impact from the power uprate on the NSSS design transients. By letter dated September 11, 2009, the staff issued RAI 4.3.1-1 requesting that the applicant: (1) provide the data of the accrued cycles for all transients that are managed and monitored, and (2) describe how the MUR 1.6-percent power uprate has been assessed and its impact on the NSSS design transients.

The applicant's October 13, 2009, response stated that the accrued cycles for all transients that are managed and monitored by its Reactor Coolant Pressure Boundary Fatigue Monitoring Program are provided in the response to RAI 4.3.1-2, Part 1. The staff's review of RAI 4.3.1-2, Part 1 and its evaluation is provided below. In response to Part 2 of RAI 4.3.1-1, the applicant stated that in support of power uprate applications in 2002 and 2007, AREVA NP reviewed the impact of its uprated plant conditions relative to the NSSS design transients. The applicant stated that the results of these evaluations were documented in the respective license amendment requests (ADAMS Accession Nos. ML021640547 and ML071220227) and that the impacts of power uprate (2002 and 2007) design conditions remain within the design conditions of the RCS functional specification. The applicant also stated that the proposed change will not result in any new design transients or adversely affect the current design transient analyses. The applicant further stated that the license amendment requests were approved as documented in the issuance of Amendment Nos. 205 (ADAMS Accession No. ML023380800) and 228 (ADAMS Accession No. ML073600419) to the facility operating license.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1 acceptable because: (1) the applicant demonstrated that it had performed a review to assess the impact of its uprated plant conditions relative to the NSSS design transients and has determined that the impacts of power uprate (2002 and 2007) design conditions remain within the design conditions of the RCS functional specification, and (2) the applicant's power uprates were approved by the NRC as documented in its respective safety evaluation (ADAMS Accession Nos. ML023380800 and ML073600419). The staff's concerns described in RAI 4.3.1-1 are resolved.

In LRA Section 4.3.1, the applicant stated there is considerable margin on the design transient cycles and that it made its 60-year CUF projection by multiplying the 40-year CUF value by a factor of 1.5. The staff noted that based on LRA Table 4.3-2, many locations already have their CUF values greater than 0.67, and a multiplication by 1.5 would result in 60-year CUF values for these locations to exceed the limit of 1.0 during the period of extended operation. The staff noted that it is unclear whether the 40-year CUF results shown in LRA Table 4.3-2 have taken into account the effects of the insurge/outsurge and the stratification thermal events for the pressurizer nozzle and surge line components. By letter dated September 11, 2009, the staff issued RAI 4.3.1-2 requesting that the applicant: (1) provide the basis for the statement that there is considerable margin on the NSSS design transient cycles and (2) clarify whether the CUFs for the pressurizer nozzle, surge line hot leg nozzle, and surge line elbows and piping as shown in LRA Table 4.3-2 have included the insurge/outsurge and the stratification transients.

The applicant's October 13, 2009, response amended its LRA and provided the data of the accrued cycles along with the 40-year design cycles for LRA Table 4.3-1. The applicant stated that in 31 years of operation, there are no transients that have exceeded 40 percent of the allowable design limit. The staff noted that the applicant's response and amended LRA Table 4.3-1 also resolves RAI 4.3.1-1, Part 1. The applicant amended its LRA to remove the references to the multiplication of CUF values with a 1.5 factor and made conforming changes to LRA Sections 4.3.1.1 through 4.3.1.7 and 4.3.2.1. The staff's review of these amendments is documented in the corresponding SER section associated with these specific LRA sections. The applicant confirmed that the CUFs for the pressurizer nozzle, surge line hot leg nozzle, and surge line elbows and piping shown in LRA Table 4.3-2 have included the insurge/outsurge and the stratification transients. The applicant stated that further detail is provided in its response to RAI 4.3.1.6-1. The staff's review of RAI 4.3.1.6-1 and its evaluation is documented in SER Section 4.3.1.6.2.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-2 acceptable because the applicant: (1) provided the data on the number of accrued cycles as of December 31, 2007 and (2) confirmed the CUFs for the pressurizer nozzle, surge line hot leg nozzle, and surge line elbows and piping have included the insurge/outsurge and the stratification transients. The staff's concerns described in RAI 4.3.1-2 are resolved.

4.3.1.1 Reactor Vessel

4.3.1.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1.1 states the RV was designed in accordance with Section III of the ASME Code – Class 1, for the replacement closure head, and Class A, for the remaining vessel items; therefore, metal fatigue was considered in the design of the RV components. The applicant further stated the CUF analyses for the RV are applicable TLAAs, since they are based on NSSS design transient cycles originally defined for 40 years. Furthermore, the NSSS design transients are those identified in LRA Table 4.3-1 and the 40-year design CUF values for the RV items are identified in LRA Table 4.3-2.

The applicant stated that for the components that are part of the RV, one pressure-retaining item has a 40-year CUF that exceeds 0.67: the lower service support structure attachment weld with a CUF of 0.72. Therefore, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation using the Reactor Coolant Pressure Boundary Fatigue Monitoring Program.

The applicant dispositioned this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.1 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

LRA Table 4.3-2 shows the 40-year CUF for all critical components and locations. One location has a 40-year CUF value greater than 0.67, the lower service support structure attachment weld with a CUF of 0.72. Based on the method stated in LRA Section 4.3.1, the projected 60-year CUF value for that location would exceed the fatigue limit of 1.0 (i.e., 0.72 x 1.5 = 1.08 > 1). In the TLAA disposition statement, the applicant stated that the effects of aging on the intended function(s) will be managed in accordance with 10 CFR 54.21(c)(1)(iii). The staff noted that it is unclear whether the disposition to 10 CFR 54.21(c)(1)(iii) shown is intended to be applicable to all components of the RV, or only for a single component that has its projected 60-year CUF exceeding the limit of 1.0. By letter dated September 11, 2009, the staff issued RAI 4.3.1.1-1, requesting that the applicant clarify which RV components will be subjected to the Reactor Coolant Pressure Boundary Fatigue Monitoring Program.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analysis and disposition discussions of LRA Section 4.3.1.1 to the following:

> For the components that are part of the RV, the maximum CUF is that of the Lower Service Support Structure attachment weld with a CUF of 0.72. Since CR-3 has determined there is no need to increase the number of NSSS design transients for the period of extended operation, the analyses remain valid for the period of extended operation.
>
> Disposition: 10 CFR 54.21 (c)(1)(i) - The analyses remain valid for the period of extended operation.

The applicant has determined that there is not a need to increase the number of NSSS design transients for the period of extended operation. The staff noted that this is a reasonable determination because, based on the applicant's accrued cycles as of December 31, 2007 (after 31 years of operation), there are no transients that have exceeded 40 percent of the design cycles. The staff noted that the applicant's 40-year design cycles are bounding based on the accrued cycles as of December 31, 2007. The staff also noted that the transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

Based on its review, the staff finds the applicant's response to RAI 4.3.1.1-1 and the applicant's amended disposition of this TLAA in accordance with 10 CFR 54.21 (c)(1)(i) acceptable because: (1) the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, and (2) the transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken. The staff's concern described in RAI 4.3.1.1-1 is resolved.

4.3.1.1.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RV in LRA Section A.1.2.2.1, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description, demonstrating that the CUF remains valid through the period of extended operation.

4.3.1.1.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA for the RV components remains valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.2 Reactor Vessel Internals

4.3.1.2.1 Summary of Technical Information in the Application

LRA Section 4.3.1.2 states that the RVIs were designed and constructed prior to the development of ASME Code requirements for core support structures; therefore, existing industry structural practice was used in the design of the internals structural members and the only specific fatigue analyses performed in the original design were those that addressed high-cycle fatigue reported in BAW-10051, “Design of Reactor Internals and Incore Instrument Nozzles for Flow Induced Vibration,” September 1, 1972. The applicant stated that, in modifications following original design, plant-specific fatigue analyses were performed for the RVIs replacement bolts as presented in BAW-1843PA, “The B&WOG Evaluation of Internals Bolting Concerns in 177 FA Plants,” January 1986, and BAW-1789P, “The B&WOG Evaluation of Internals Bolting Concerns in 177 FA Plants,” August 1984. The applicant stated that these topical reports summarize fatigue analyses performed to the ASME Code Section III, Subsection NG, including both high-cycle fatigue from flow induced vibrations (FIV) and low-cycle fatigue from NSSS design transients.

The applicant provided its analysis for the FIV endurance limit assumptions and CUFs for RVIs replacement bolts. The applicant stated that for the FIV endurance limit assumptions, the analysis has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii). The applicant further stated that for the CUFs for RVIs replacement bolts, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation using the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.2 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the FIV related high-cycle fatigue TLAA is projected to the end of the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) for the RVIs replacement bolts will be adequately managed for the period of extended operation. The staff noted that as a result of RAI 4.3.1-2, the applicant amended its LRA such that this TLAA for the RVIs replacement bolts is dispositioned, in accordance with 10 CFR 54.21(c)(1)(i), and that the TLAA remains valid during the period of extended operation.

The staff reviewed the FIV related high-cycle fatigue evaluation and noted that very low numbers of cycles (e.g., 106 cycles) are used to determine the corresponding “endurance limit.” The staff noted that the endurance limit for steel typically corresponds to fatigue life well above millions of cycles. The staff also noted that the applicant described how it determined the “endurance limit” and concluded that the applied stress shown in the BAW-10051 report for the original high-cycle fatigue analysis is acceptable. However, the staff noted that the LRA does not contain sufficient information to assess the applicant’s evaluation and conclusion. By letter dated September 11, 2009, the staff issued RAI 4.3.1.2-1 requesting that the applicant: (1) confirm the number of cycles used to determine the “endurance limit;” (2) specify the material, temperature, and maximum alternating stress used in BAW-10051 for the fatigue analysis; and (3) provide the figure number and curve number of the ASME Code Section III design fatigue curve (S-N curve) used for the endurance limit determination and provide the basis of choosing the fatigue curve used in the endurance limit calculation and the results.

The applicant’s October 13, 2009, response to RAI 4.3.1.2-1, Part 1 amended the “FIV Endurance Limit” section of the LRA as follows:

> BAW-10051 calculated stress values for the redesigned RVI and compared them to endurance limit stress values. These endurance limit values were based on an assumed value of 10^{12} cycles for 40 years of operation. Since the fatigue curves at the time of design only went up to 10^{6} cycles, these curves were extrapolated to 10^{12} cycles. The methodology used in BAW-10051 was extended from 40 years to 60 years by multiplying the assumed endurance limit cycles by 1.5 and then using 10^{13} cycles to determine the endurance limit based on more recent ASME fatigue curves which extend now to 10^{11} cycles (Figure 1-9.2.2 of ASME Section III, 1986 Edition). The component item stress values in BAW-10051 were compared to the recalculated endurance limit values and were shown to be acceptable. Therefore, the FIV analysis has been projected to the end of the period of extended operation.

The staff noted that the numbers originally shown as 106, 1011, 1012, and 1013 in the LRA were revised to 10^{6}, 10^{11}, 10^{12}, and 10^{13}, respectively. The staff noted that the original numbers provided in the LRA were typographical errors and that the amended LRA Section 4.3.1.2 includes the number of cycles for the endurance limit that are reasonable.

The applicant’s October 13, 2009, response to RAI 4.3.1.2-1, Part 2, stated that the RVIs non-bolting subcomponents are fabricated from stainless steel and high-strength bolting is fabricated either from stainless steel or nickel-based alloy. The applicant provided a step-by-step illustration of the endurance limit calculations and provided the alternating stress data to support its fatigue usage evaluations. The staff noted that the applicant provided the information requested on material and the maximum alternating stress used in BAW-10051 for the fatigue analysis. The staff noted that the temperature information is reflected in its endurance limit calculation illustrations. The staff noted that the applicant incorporated a 10 percent reduction of the calculated endurance limit, know as a “thermal adjustment.” The staff finds this adjustment adequate because it implies that the ASME design S-N curve used in the fatigue calculation has been adjusted to temperature values typical to the normal plant operating temperature, which is approximately 650 °F.

The applicant’s October 13, 2009, response to RAI 4.3.1.2-1, Part 3 presented information on the basis for choosing curve B of Figure I-9.2.2 (ASME Section III, 1986 Edition) and the method of endurance limit calculations in its response to RAI 4.3.1.2-1, Part 2. The staff noted that the most severe among the curves A, B, and C is curve C and is applicable to the cases where the primary plus secondary stress range is greater than 27,200 pounds per square inch (psi). The applicant stated that the highest peak stress range for the RVI is 23,000 psi and that curve B is the next most conservative. The staff finds it reasonable that the applicant selected curve B because the highest peak stress range for the RVI is 23,000 psi, which does not meet the criteria for using curve C, and curve B is the next most conservative.

Based on its review, the staff finds the applicant's response to RAI 4.3.1.2-1 acceptable because the applicant: (1) amended its LRA to properly identify that the endurance limits were calculated based on corrected cycles (i.e., 10^6, 10^{11}, 10^{12}, and 10^{13}), (2) demonstrated that the values of the cycles indicated in the LRA were typographical errors, (3) provided the information about the maximum alternating stress used in BAW-10051 and the material type (stainless steel) has conservatively adjusted the S-N curve which reflects the maximum operating temperature, and (4) conservatively chose curve B as described above. The staff's concerns described in RAI 4.3.1.2-1 are resolved.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analysis and disposition discussions for the "Cumulative Usage Factors for RV Internals Replacement Bolts" in LRA Section 4.3.1.2 to the following:

> The RV internals bolts that were replaced at CR-3 include 120 Upper Core Barrel bolts made from A-286, 60 Lower Core Barrel bolts made from X-750, 96 Lower Thermal Shield bolts made from X-750, and 72 Surveillance Specimen Holder Tube (SSHT) bolts made from X-750. The maximum CUF for these components is for the lower thermal shield bolts with CUF of 0.84. Since CR-3 has determined there is no need to increase the number of NSSS design transients for the period of extended operation, the analyses remain valid for the period of extended operation.
>
> Disposition 10 CFR 54.21 (c)(1)(i) - The analyses remain valid for the period of extended operation.

Based on its review, the staff finds acceptable the applicant's response to RAI 4.3.1.2-1 and the applicant's amended disposition of this TLAA in accordance with 10 CFR 54.21 (c)(1)(i) because: (1) the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, and (2) the transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken. The staff's concern described in RAI 4.3.1.2-1 is resolved.

4.3.1.2.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RVIs in LRA Section A.1.2.2.2, as amended by letter dated October 13, 2009, in response to RAIs 4.3.1-2 and 4.3.1.2-1. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RVIs.

4.3.1.2.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the results of the FIV related high-cycle fatigue TLAA of RVIs were projected to the end of the period of extended operation. Additionally, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA for the RVIs replacement bolts remains valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.3 Control Rod Drive Mechanisms

4.3.1.3.1 Summary of Technical Information in the Application

LRA Section 4.3.1.3 states that the "Type C" control rod drive mechanism (CRDM) motor tube was designed in accordance with ASME Code Section III, Class A, 1968 Edition with Addenda through summer 1970, and metal fatigue was considered in the design of the component. The applicant stated the CUFs of the CRDM motor were not calculated as it was shown that the motor tube did not require analysis for cyclic operation in accordance with ASME Code Section III, paragraph N-415.1. The applicant further stated that the calculations performed to comply with N-415.1 are applicable TLAAs since they are based on NSSS design transient cycles originally defined for 40 years of operation.

The applicant stated the calculations performed in accordance with N-415.1(a) through N-415.1(f) of the ASME Code Section III for the CRDM motor tube are based on NSSS design transients. The applicant further stated the NSSS design transients have not been increased for the period of extended operation and, therefore, the analyses performed in accordance with N-415.1(a) through N-415.1(f) of the ASME Code Section III are acceptable for the period of extended operation since the NSSS design transients have not been revised. The applicant stated that for this TLAA, the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.3 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA remains valid during the period of extended operation.

The staff noted that the LRA does not provide sufficient information to confirm whether the applicant has performed the fatigue evaluation for the CRDM motor tube in its design package. In addition, the applicant did not provide the basis to justify that the CRDM motor tube can be exempted from fatigue usage calculations. By letter dated September 11, 2009, the staff issued RAI 4.3.1.3-1 requesting that the applicant: (1) clarify whether the CUF analysis for the CRDM motor tube was completed, and (2) describe how ASME Code Section III, paragraph N-415.1 endorses exemption of fatigue usage calculation for the CRDM motor tube.

The applicant's October 13, 2009, response to Part 1 stated that CUFs of the CRDM motor tube were not calculated because the motor tube satisfies the requirements for all conditions described in items (a) through (f), ASME Code Section III, paragraph N-415.1 (1965 Edition with Addenda through 1967).

The applicant's October 13, 2009, response to Part 2 stated that it reviewed the CRDM Type C stress report and confirmed that NSSS design transients were used to show compliance to the conditions specified in paragraph N-415.1, items (a) through (f). The applicant concluded that since it is not revising the number or definition of NSSS design transients, the exemption from fatigue analysis established in the design phase remains valid for the period of extended operation.

The applicant's October 13, 2009, letter contained LRA Amendment No. 5 which revised LRA Section 4.3.1.3 to state that "The 'Type C' control rod drive mechanism (CRDM) motor tube was designed in accordance with ASME Code, Section III, Class A, 1965 Edition with Addenda through Summer 1967, and metal fatigue was considered in the design of the component." The staff notes that this LRA amendment makes the LRA consistent with the applicant's RAI response.

Based on its review, the staff finds the applicant's response to RAI 4.3.1.3-1 acceptable because the applicant confirmed that a CUF analysis for the CRDM motor tube was not performed since it satisfied the requirements for all conditions described in items (a) through (f), ASME Code Section III, paragraph N-415.1 (1965 Edition with Addenda through 1967) and since the applicant is not revising the number or definition of NSSS design transients, the exemption from fatigue analysis established in the design phase remains valid for the period of extended operation.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because the original NSSS design transients are not being revised or redefined, therefore, the exemption is valid for the period of extended operation.

4.3.1.3.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of CRDM in LRA Section A.1.2.2.3. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the CRDM.

4.3.1.3.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of CRDM will remain valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.4 Reactor Coolant Pumps

4.3.1.4.1 Summary of Technical Information in the Application

LRA Section 4.3.1.3 states that the RCPs were designed in accordance with the ASME Code Section III, Class A, but were not code stamped, and metal fatigue was considered in the design of the component. The applicant stated the CUFs of the RCPs are applicable TLAAs since the CUFs are based on NSSS design transient cycles originally defined for 40-years of operation.

The applicant stated the RCP items listed in LRA Table 4.3-2 have CUFs below 0.67 and the RCP cover has the largest 40-year design usage factor at 0.65. The applicant further stated the calculations performed in accordance with N-415.1(a) through N-415.1(f) of the ASME Code Section III for the RCP seal and heat exchanger are based on NSSS design transients. The applicant stated the NSSS design transients have not been increased for the period of extended operation and based on the above, the analyses for the RCP casing, cover, and shaft have been projected to the end of the period of extended operation and the analyses of the RCP seal and heat exchanger performed in accordance with N-415.1(a) through N-415.1(f) of the ASME Code Section III are acceptable for the period of extended operation since the NSSS design transients have not been revised.

The applicant stated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) and the analyses have been projected to the end of the period of extended operation since the maximum CUF for RCP items is less than 0.67, in accordance with 10 CFR 54.21(c)(1)(ii).

4.3.1.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.4 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that applicable portions of the TLAA remain valid during the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(ii), that applicable portions of the TLAA are projected to the end of the period of extended operation.

The staff noted that in LRA Section 4.3.1.4, the applicant dispositioned these TLAAs for the RCP components pursuant to both 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii). However, the staff also noted that the regulatory disposition statements should be specific if not all parts of the analysis are in accordance with the same disposition. By letter dated September 11, 2009, the staff issued RAI 4.3.1.4-1 requesting that the applicant identify which part or locations of the RCP are in accordance with 10 CFR 54.21(c)(1)(i) and which are in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant's October 13, 2009, response stated that, since the NSSS design transients will not be revised for the period of extended operation as explained in its response to RAI 4.3.1-1, the original CUF calculations for the RCP (casing, cover, and lower shaft) and the exemption from fatigue evaluations for the seal and heat exchanger all remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Based on its review, the staff finds the applicant's response to RAI 4.3.1.4-1 acceptable because the applicant clarified that: (1) the NSSS design transients will not be revised for the period of extended operation and (2) the original CUF calculations for the RCP (casing, cover, and lower shaft) and the exemption from fatigue evaluations for the seal and heat exchanger all remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The staff's concern described in RAI 4.3.1.4-1 is resolved.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analysis and disposition discussions in LRA Section 4.3.1.4 to the following:

> The RCP pump cover has the largest 40-year design usage factor at 0.65. Calculations performed in accordance with N-415.1 (a) through N-415.1 (f) of the ASME Code, Section III, for the RCP seal and heat exchanger are based on

NSSS design transients. The NSSS design transients for CR-3 have not been increased for the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(i) - The analyses remain valid for the period of extended operation.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, and these transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

4.3.1.4.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RCP in LRA Section A.1.2.2.4, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RCP.

4.3.1.4.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of RCP components will remain valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.5 Steam Generators

4.3.1.5.1 Summary of Technical Information in the Application

LRA Section 4.3.1.5 states that the once-through steam generators (OTSGs) were designed in accordance with the ASME Code Section III, Class A and metal fatigue was considered in the design of the components. The applicant stated the CUFs of the OTSG components are applicable TLAAs since the CUFs are based on NSSS design transient cycles originally defined for 40 years of operation.

The applicant stated that for the components that are part of the OTSG, five items have 40-year CUFs that exceed 0.67: the emergency feedwater nozzle studs, main feedwater nozzle, mechanical sleeves, remote welded plug, and the support skirt. The CUF values for these components range from 0.89 to 0.97.

The applicant stated that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation by means of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.5.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.5 to verify that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analysis and disposition discussions in LRA Section 4.3.1.5 to the following:

> The maximum CUF for the OTSG is for the EFW [emergency feedwater] Nozzle Studs with a CUF of 0.97. Since CR-3 has determined there is no need to increase the number of NSSS design transients for the period of extended operation, the analyses remain valid for the period of extended operation.
>
> Disposition: 10 CFR 54.21(c)(1)(i) - The analyses remain valid for the period of extended operation.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, and these transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

4.3.1.5.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of steam generators in LRA Section A.1.2.2.5, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the steam generators.

4.3.1.5.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAAs for the steam generator components remain valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.6 Pressurizer

4.3.1.6.1 Summary of Technical Information in the Application

LRA Section 4.3.1.6 states that the pressurizer was designed in accordance with the ASME Code Section III, Class A and metal fatigue was considered in the design of the component. The applicant stated the pressurizer surge nozzle was modified in 2007 to include a weld overlay over the Alloy 600 weld that connects the surge nozzle to a stainless steel safe end and the weld overlay was designed in accordance with the 1989 Edition of ASME Code Section III, Subsection NB. The applicant further stated the CUFs for the pressurizer are applicable TLAAs since they are based on NSSS design transient cycles originally defined for 40 years.

The applicant stated that three items of the pressurizer have 40-year CUFs that exceed 0.67: (1) the surge nozzle with weld overlay, (2) the heater bundle closure seal weld, and (3) the thermowell nozzle.

The applicant stated that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii)

4.3.1.6.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.6 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff noted that the LRA does not provide information regarding the applicant's position on stratification and insurge/outsurge events for the pressurizer surge lines or its response to NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," that requested all PWR plants to include these thermal events in the fatigue evaluations to ensure ASME Code compliance. By letter dated September 11, 2009, the staff issued RAI 4.3.1.6-1 requesting that the applicant: (1) confirm whether the fatigue evaluations for the pressurizer surge nozzle including lower head region, surge line piping, and surge line hot leg nozzle have taken stratification and insurge/outsurge events into account and (2) discuss how the heatup and cooldown cycles that occurred prior to December 20, 1988 (the date of issuance for Bulletin 88-11), for the pressurizer surge line stratification and insurge/outsurge events before the dates of issuance of NRC Bulletins 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," and 88-11 were reconstructed.

The applicant's October 13, 2009, response to Part 1 stated that the structural evaluations for the pressurizer surge nozzle, surge line, and hot leg surge nozzle are described in BAW-2127, "Babcock & Wilcox Owners Group, Final Submittal for Nuclear Regulatory Commission Bulletin 88-11, 'Pressurizer Surge Line Thermal Stratification.'" The applicant also stated the effects of thermal stratification in the lower head of the pressurizer is included in the CUFs reported in LRA Table 4.3-2 for the pressurizer.

The applicant's October 13, 2009, response to Part 2 provided a summary of how it reconstructed the heatup and cooldown cycles that occurred prior to December 20, 1988, for the pressurizer surge line stratification and insurge/outsurge events before the dates of issuance of NRC Bulletins 88-08 and 88-11. The staff noted that the applicant used plant-specific data to perform this reconstruction.

Based on its review, the staff finds the applicant's response to RAI 4.3.1.6-1 acceptable because the applicant: (1) confirmed that the effects of thermal stratification in the lower head of the pressurizer is included in the CUFs and (2) reconstructed its heatup and cooldown cycles prior to the dates of issuance of NRC Bulletins 88-08 and 88-11 with plant-specific data. The staff's concerns described in RAI 4.3.1.6-1 are resolved.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analysis and disposition discussions in LRA Section 4.3.1.6 to the following:

> For the components that are part of the Pressurizer, the Heater Bundle closure seal weld has the highest CUF with a value of 0.86. Since CR-3 has determined

there is no need to increase the number of NSSS design transients for the period of extended operation, the analyses remain valid for the period of extended operation.

Disposition 10 CFR 54.21 (c)(1)(i) - The analyses remain valid for the period of extended operation.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, and these transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

4.3.1.6.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of the pressurizer in LRA Section A.1.2.2.6, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the pressurizer.

4.3.1.6.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue TLAA for the pressurizer remains valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.7 Reactor Coolant Pressure Boundary Piping

4.3.1.7.1 Summary of Technical Information in the Application

LRA Section 4.3.1.7 states that RCPB piping (USAS B31.7) includes all piping within the ASME Code Section XI, Subsection IWB inspection boundary, such as B&W-supplied main coolant piping and portions of Architect/Engineer-supplied ancillary systems (e.g., decay heat removal, core flood, and makeup and purification systems), including low pressure injection, high pressure injection, and makeup/letdown piping attached to the RCS piping. The applicant stated the IWB inspection boundary within the ancillary systems typically extends to the first or second isolation valve or to a flow restricting orifice. The applicant further stated that the B&W-supplied main coolant piping was designed in accordance with USAS B31.7 and the ancillary systems connected to the main coolant piping were designed in accordance with USAS B31.1.

The applicant stated that the scope of USAS B31.7 piping includes the 36-inch hot leg piping, including attached branch connections and safe ends; 28-inch cold leg piping, including attached branch connections and safe ends; pressurizer surge line piping; and pressurizer spray line piping. The applicant further stated the CUFs of USAS B31.7 RCPB piping are applicable TLAAs since they are based on NSSS design transient cycles originally defined for 40 years of operation.

The applicant stated that for the components that are part of the RCPB piping, the pressurizer spray line piping and high pressure injection/makeup (HPI/MU) nozzle safe end CUFs exceed 0.67 at 40 years. The applicant further stated in accordance with NRC letter (H. Silver) to FPC (P. Beard), "Crystal River Unit 3 – NRC Bulletin 88-08 'Thermal Stress in Piping Connected to Reactor Coolant Systems,' (TAC No. M69621)," dated June 18, 1992, the piping items within the scope of NRC Bulletin 88-08 include the HPI/MU nozzle, safe end, and thermal sleeve. Therefore, fatigue of the HPI/MU nozzle, safe end, and thermal sleeve is evaluated above for the period of extended operation.

The applicant stated that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation by means of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.7.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.7 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The applicant's October 13, 2009, response stated that, based on its response to RAI 4.3.1-2, it has revised the analyses in LRA Section 4.3.1.7 to state that there is no need to increase the number of NSSS design transients for the period of extended operation. Therefore, the disposition in LRA Section 4.3.1.7 was revised to 10 CFR 54.21(c)(1)(i) because the analyses remain valid for the period of extended operation.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because: (1) the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007; (2) these transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken; and (3) the maximum CUF in the RCPB (USAS B31.7) piping is within the design limit for the cycles of all transients bounded by the design cycles.

4.3.1.7.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RCPB piping in LRA Section A.1.2.2.7, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RCPB piping.

4.3.1.7.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue TLAA for the RCPB piping remains valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2 Implicit Fatigue Analysis (B31.1 Piping)

The applicant stated that the RCPB piping evaluated in LRA Section 4.3.1.7 included the original B&W scope of supply that was designed in accordance with USAS B31.7. The applicant stated that the RCPB piping within ancillary systems attached to the main coolant piping and designed in accordance with USAS B31.1.0 are discussed in LRA Section 4.3.2.1 for Class 1 piping and in LRA Section 4.3.2.2 for non-Class 1 piping.

4.3.2.1 USAS B.31.1.0 Piping – Reactor Coolant Pressure Boundary Class 1

4.3.2.1.1 Summary of Technical Information in the Application

LRA Section 4.3.2.1 states that RCPB Class 1 piping designed in accordance with USAS B31.1.0 includes piping in ancillary systems connected to the B&W-supplied main coolant piping, including the decay heat removal, core flood, and makeup and purification systems, and including low pressure injection, high pressure injection, and makeup/letdown piping.

The applicant stated that the USAS B31.1.0 design does not require analyses of cumulative fatigue usage, but cyclic loading was considered in a simplified manner in the design process. The applicant further stated the overall number of thermal cycles expected during the 40-year lifetime of these components was compared to limits (7,000 cycles or more) above which stress range reduction factors had to be applied to the allowable stress range for secondary stresses (expansion and displacement) to account for thermal cycling and these components are considered to have implicit fatigue analyses.

The applicant determined that since the overall number of cycles could potentially increase during the period of extended operation, these implicit fatigue analyses are also considered to be TLAAs requiring evaluation for the period of extended operation. The applicant stated that for piping designed in accordance with the USAS B31.1.0-1967 Code rules, the designer was required to determine the overall number of thermal cycles anticipated for the component in 40 years and was required to apply stress range reduction factors if this number exceeded 7,000.

The applicant stated that since these analyses were based upon the number of cycles expected to occur during the original license period, these analyses are also considered to be TLAAs and all RCPB piping attached to the B&W scope of supply was designed in accordance with USAS B31.1.0. The applicant further stated that the spool piece that is connected to the HPI/MU safe end was designed to USAS B31.1.0 but was analyzed for fatigue using USAS B31.7 in response to NRC Bulletin 88-08.

The applicant stated the applicable transient cycles for piping systems designed in accordance with USAS B31.1.0-1967 rules were originally determined by summing the individual transients to which the component would be exposed in 40 years. The applicant further stated that in order to evaluate these TLAAs for 60 years, the number of cycles now expected to occur in 60 years should be compared to the number of design cycles that were considered in these analyses. Therefore, for the RCPB systems, the number of thermal cycles correlates with plant heatups and cooldowns, which are limited to 240 cycles per LRA Table 4.3-1. The applicant stated that since the transient set (and associated cycles) in the RCS Functional Specification is being maintained, the analytical basis for these components remain unchanged. The applicant stated that the analyses for these components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The applicant analyzed the CUF for HPI/MU safe end spool piece. The applicant stated the HPI/MU safe end is welded to a stainless steel spool piece that was analyzed for fatigue analysis in accordance with USAS B31.7 to support NRC Bulletin 88-08. The applicant stated the 40-year CUF for the spool piece is 0.94. The applicant further stated that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation by means of the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.1 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA remains valid during the period of extended operation for the Class 1 B31.1.0 piping excluding the HPI/MU safe end spool piece and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation for the HPI/MU safe end spool piece.

The staff noted that the LRA does not provide a basis for dispositioning this class of piping (except for the HPI/MU safe end spool piece) in accordance with 10 CFR 54.21(c)(1)(i). The staff further noted that by summing up the number of cycles from all transients shown in LRA Table 4.3-1, it equates to 4,957 cycles which would yield 7,436 cycles after multiplying by 1.5, which exceeds the 7,000 cycle limit from the USAS B31.1.0 Code. By letter dated September 11, 2009, the staff issued RAI 4.3.2.1-1 requesting that the applicant: (1) provide justification that the TLAA for the Class 1 piping components remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i) and (2) provide justification that the TLAA for the portion of the non-Class 1 piping components where the cycles are unrelated to the heatups and cooldowns can be projected to the end of the period of extended operation.

The applicant's October 13, 2009, response to Part 1 stated that the response to RAI 4.3.1-2 provides the discussion supporting the conclusion that the design transients will not be exceeded, therefore, summing up the transients does not exceed the 7,000 cycle limit. The applicant revised the LRA to delete references to the factor of 1.5 and delete the entire discussion and disposition for "Cumulative Usage Factor for HPI/MU Safe End Spool Piece" under LRA Section 4.3.2.1.

The applicant's October 13, 2009, response to Part 2 stated that its response to RAI 4.3.2.2.1-1 provided a complete discussion on the qualification of components whose cycles do not track with heatups and cooldowns. The staff noted that RAI 4.3.2.1-1, Part 2 is intended for non-Class 1 piping components, therefore, the staff's review of the applicant's response to this portion of RAI 4.3.2.1-1 is documented in SER Section 4.3.2.2.2.

Based on its review, the staff finds the applicant's response to RAI 4.3.2.1-1, Part 1 acceptable because the applicant's 40-year design cycles specified in its FSAR are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, such that the 7,000 cycle limit is not exceeded. The staff's concerns described in RAI 4.3.2.1-1, Part 1 are resolved.

Based on its review, the staff finds the applicant's disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) acceptable because the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007, such that the

7,000 cycle design limit is not exceeded and these transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

4.3.2.1.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RCPB Class 1 USAS B31.1.0 piping in LRA Section A.1.2.2.8, as amended by letter dated October 13, 2009, in response to RAI 4.3.1-2. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.3, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RCPB Class 1 USAS B31.1.0 piping.

4.3.2.1.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of RCPB Class 1 USAS B31.1.0 piping components will remain valid during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2.2 USAS B31.1.0 Piping – Non-Class 1

4.3.2.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2.2 states that piping designed in accordance with USAS B31.1.0 was not required to have analyses of cumulative fatigue usage, but cyclic loading was considered in a simplified manner in the design process. The applicant stated the overall number of thermal cycles expected during the 40-year lifetime of these components was compared to limits (7,000 cycles or more) above which stress range reduction factors had to be applied to the allowable stress range for secondary stresses (expansion and displacement) to account for thermal cycling. The applicant further stated that these non-Class 1 components are considered to have implicit fatigue analyses.

The applicant stated that since the overall number of cycles could potentially increase during the period of extended operation, these implicit fatigue analyses are also considered to be TLAAs requiring evaluation for the period of extended operation. The applicant further stated for piping designed in accordance with the USAS B31.1.0-1967 Code rules, the designer was required to determine the overall number of thermal cycles anticipated for the component in 40 years and was required to apply stress range reduction factors if this number exceeded 7,000.

The applicant analyzed components with cycles related to RCS heatups and cooldowns. The applicant stated that the applicable transient cycles for piping systems designed in accordance with USAS B31.1.0-1967 rules were originally determined by summing the individual transients to which the component would be exposed in 40 years. In order to evaluate these TLAAs for 60 years, the number of cycles now expected to occur in 60 years should be compared to the number of design cycles that were considered in these analyses. The applicant further stated that for most systems, the number of thermal cycles correlates with plant heatups and cooldowns, which are limited to 240 cycles per LRA Table 4.3-1. The applicant determined the applicable systems include steam and power conversion systems and components and engineered safety features systems connected to the RCS. The applicant determined that since the transient set (and associated cycles) in the RCS Functional Specification is being maintained, the analytical basis for these components remain unchanged. The applicant stated the analyses for these components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The applicant analyzed components with cycles unrelated to RCS heatups and cooldowns. The applicant stated that for components in systems whose cycles do not track plant heatups and cooldowns, a specific evaluation of the components operating history was performed. The applicant stated that examples of components in this group include engine exhaust components for diesel engines in the emergency diesel generator, emergency feedwater and fire protection systems, sampling piping and components in the liquid and post-accident liquid sampling systems, and the turbine-driven emergency feedwater pump turbine. The applicant further stated the evaluations were performed that projected the number of expected cycles in 60 years. The applicant stated the analyses have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.2 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA for the components subjected to cycles related to RCS heatups and cooldowns remains valid during the period of extended operation. The staff also verified, pursuant to 10 CFR 54.21(c)(1)(ii), that the TLAA for the components subjected to cycles unrelated to RCS heatups and cooldowns is projected to the end of the period of extended operation.

Based on its review, the staff finds the applicant’s disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i) for the components subjected to thermal cycles related to RCS heatups and cooldowns is acceptable because the number of expected thermal cycles from heatups and cooldowns is small (240 heatup/cooldown cycles) when compared with the 7,000 cycle design limit threshold for non-Class 1 USAS B31.1.0 piping components.

For the components whose cycles are not tracked with heatup/cooldown events, the staff noted that the LRA does not provide sufficient information to justify the disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(ii). By letter dated September 11, 2009, the staff issued RAI 4.3.2.1-1, Part 2 requesting that the applicant provide justification that the TLAA for the portion of the non-Class 1 piping components where the cycles are unrelated to the heatups and cooldowns can be projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant’s October 13, 2009, response to RAI 4.3.2.1-1 referenced the applicant’s response to RAI 3.3.2.2.1-1 which stated that for those systems in the category whose cycles are not tracked with heatups and cooldowns, a specific evaluation of the component’s operating history was performed, a basis provided for future operation, and a disposition provided.

The applicant stated the emergency feedwater pump No. 3 diesel engine exhaust expansion joints, silencers, and piping in the air handling ventilation and cooling system and emergency feedwater pump building ventilation system are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii) and the resulting number of cycles is less than 7,000 cycles. The staff noted that in order to come to this determination, the applicant reviewed its functional design specification to determine the design number of cycles associated with the introduction of emergency feedwater and in addition to these occasions, the diesel is tested according to the requirements of the inservice testing program. The applicant further stated that the program plan indicates that the pump is tested quarterly.

The applicant stated the turbine drive and associated piping for the turbine-driven emergency feedwater pump in the emergency feedwater system is dispositioned in accordance with 10 CFR 54.21(c)(1)(ii) and the resulting number of cycles is less than 7,000 cycles. Also, the turbine-driven pump requires a full flow test on the turbine-driven emergency feedwater pump No. 2 (EFP-2) each refueling outage as set forth by the NRC in Generic Letter (GL) 89-04, Position 9, concerning pumps that are normally tested in minimum-flow recirculation lines, and a commitment to perform such a test. The applicant stated this test is performed in addition, and as a supplement, to ASME Code Section XI quarterly testing of EFP-2 in the minimum-flow recirculation line. The applicant has determined that these additional cycles added to those calculated in the evaluation described above resulted in less than 7,000 total cycles.

The applicant stated the piping and components in the liquid sampling system and post-accident liquid sampling system are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii). The applicant stated that since there was the potential to induce a full temperature cycle each time a sample is drawn, an evaluation of the cyclic behavior of the sampling systems was required and a generic stress analysis was performed for these piping components based on the seismic support criteria for 2-inch diameter and smaller piping and the number of anticipated cycles for 60 years. The staff noted that the applicant applied an appropriate stress range reduction factor to the allowable stress and demonstrated that these piping components will remain qualified.

The applicant stated the emergency diesel generator diesel exhaust piping, expansion joints, and silencers in the emergency diesel generator system are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii). The applicant stated that these components undergo a cycle each time the diesel is started and the number of cycles associated with 60 years of diesel surveillance tests added to the number of design cycles for a station blackout accident and the number of cycles the diesels were expected to start in response to a degraded voltage condition resulted in less than 7,000 total cycles.

The applicant stated the piping, piping components, standpipes, hydrants, and tanks for the diesel-driven fire protection pumps in the fire protection system are dispositioned in accordance with 10 CFR 54.21(c)(1)(ii). The applicant stated the diesel exhaust piping is exposed to diesel exhaust and will undergo a cycle each time the diesel is started. The applicant further stated the fire pump surveillance requirements of the Fire Protection Plan directs that, once every 31 days, the diesel engine be started from ambient conditions and, in addition, once every 18 months it must be verified that the diesel starts from ambient conditions on the auto-start signal. The applicant has determined the number of cycles for 60 years was calculated and resulted in less than 7,000 total cycles.

Based on its review, the staff finds the applicant’s response to RAI 4.3.2.1-1 and the applicant’s disposition of these components in accordance with 10 CFR 54.21(c)(1)(ii) acceptable because the applicant has evaluated and projected the number of cycles these components will undergo and has determined they are less than the 7,000 cycles for the design limit or used the appropriate stress range reduction factor to demonstrate that the components will remain qualified. The staff’s concerns described in RAI 4.3.2.1-1 are resolved.

4.3.2.2.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of RCPB non-Class 1 USAS B31.1.0 piping in LRA Section A.1.2.2.9. Based on its review of the FSAR supplement consistent with SRP-LR Section 4.3.3.3, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RCPB non-Class 1 USAS B31.1.0 piping.

4.3.2.2.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of RCPB non-Class 1 USAS B31.1.0 piping, for the components subjected to cycles related to RCS heatups and cooldowns, will remain valid during the period of extended operation. The staff also concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses of RCPB non-Class 1 USAS B31.1.0 piping, for the components subjected to cycles unrelated to RCS heatups and cooldowns, are projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Effects of Reactor Water Environment on Fatigue Life

4.3.3.1 Summary of Technical Information in the Application

LRA Section 4.3.3 states that the effects of reactor water environment on fatigue were evaluated for a subset of representative components that were selected based on NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." The applicant stated that the representative components evaluated are the RV shell and lower head (including incore instrumentation nozzles), RV inlet and outlet nozzles, pressurizer surge line (including hot leg and pressurizer surge nozzles), HPI/MU nozzle, core flood nozzle, and decay heat removal system Class 1 piping.

The applicant stated the methods used to evaluate environmental effects on fatigue were based on NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low Alloy Steels;" NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels"; and NUREG/CR-6717, "Environmental Effects of Fatigue Crack Initiation in Piping and Pressure Vessel Steels." The applicant further stated the method used to obtain environmental effects for nickel-based alloy was obtained from H. S. Metha and S. R. Goeeslin, "Environmental Factor Approach to Account for Water Effects in Pressure Vessel and Piping Fatigue Evaluations," Nuclear Engineering and Design, 1998. The applicant stated the environmental fatigue life correction factors (F_{en}) were used to obtain adjusted cumulative fatigue usage (U_{en}) which includes the effects of reactor water environments.

The applicant stated the evaluations at all locations are based on application of environmental penalty factors to the ASME Code 40-year CUF values. The applicant stated that it used the bounding F_{en} values of 2.45 for low alloy steel, 15.35 for stainless steel, and 1.49 for Alloy 600 and applied these values to the 40-year design CUFs, with the exception of surge line piping and decay heat injection piping.

The applicant stated for surge line piping, the ASME Code Section III analysis of record was revised to include the effects of environmentally-assisted fatigue (EAF). The applicant further stated the environmental correction factor F_{en} from NUREG/CR-5704 was used to determine the number of allowable cycles for each load pair and was obtained by integration from peak to valley considering transformed metal temperature (T*), transformed strain rate (ε*), and transformed dissolved oxygen (O*). The applicant assumed a strain rate of 0.0004 percent/second or less, and ε* was held constant at 0.001. The applicant used its historical data to determine dissolved oxygen (DO) is 0.05 parts per million (ppm) or less, and transformed O* was held constant at 0.026. The applicant stated that it determined the transformed metal service temperature by integration of metal temperature for the load pair analyzed. The applicant stated that it determined the F_{en} varies for the surge line piping from 2.55 (when metal temperature is less than 392 °F) to a maximum of 15.35 (when metal temperature equals or exceeds 392 °F).

The applicant stated that thermal striping was considered separately and was assigned a F_{en} of 1.0 as the maximum calculated strain amplitude is less than the threshold strain amplitude of 0.097 percent listed in NUREG/CR-5704.

The applicant further stated that the decay heat injection piping was designed in accordance with USAS B31.1 and, therefore, did not receive an explicit CUF evaluation. The applicant stated fatigue evaluation of the decay heat injection piping was performed specifically for license renewal using USAS B31.7, 1969 Edition, and the CUF was multiplied by a bounding F_{en} value of 2.55.

The applicant stated that based on the results of this evaluation, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation using the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In its review of the environmental fatigue analyses, the staff finds there are several areas that need clarification and additional information to enable the staff to make proper evaluations. Additionally, there are concerns on the weld overlay related area and on the reactor water chemistry, especially on the data for DO. Therefore, the staff issued a number of related RAIs, as described in the following paragraphs.

LRA Page 4.3-12 states that “Evaluations at all locations are based on application of environmental penalty factors to the ASME 40-year CUF values.” However, the staff noted that based on the CUF projection method described in LRA Section 4.3, the projected 60-year CUF is 1.5 times the 40-year CUF value for each location. The staff noted that this means that the EAF usage calculated based on the 40-year CUF value would be nonconservative. By letter dated September 11, 2009, the staff issued RAI 4.3.3-1 requesting that the applicant: (1) provide the basis that 40-year CUF instead of 60-year CUF can be used as the basis for calculating the environmentally adjusted CUF; (2) provide the basis that the O* for stainless steel components is 0.026 when the DO level is below the threshold value of 0.05 ppm; and

(3) provide the following input data used for the fatigue analysis for decay heat injection piping: temperature, transient set, and the base CUF value being multiplied by the F_{en} factor.

The applicant's October 13, 2009, response to Part 1 stated that the response to RAI 4.3.1-2 provides a discussion supporting the conclusion that the cycles of the design transients will not be exceeded for 60 years of operation. Thus, the applicant concluded that the 40-year CUF values remain valid for the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-1, Part 1 acceptable because, as described in SER Section 4.3.1, the staff has concluded that the applicant has adequately demonstrated that the 40-year CUF values remain valid for the period of extended operation and the transients that affect the CUF will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

The applicant's October 13, 2009, response to Part 2 stated that the transformed oxygen used in the EAF evaluation of the surge line is 0.26 instead of 0.026. The staff noted that this was a typographical error and the applicant amended its LRA accordingly, such that the correct value of 0.26 is referenced. The staff finds that it is reasonable to assume that DO is maintained below 0.05 ppm throughout the entire RCS because the applicant maintains hydrogen overpressure in accordance with the Electric Power Research Institute (EPRI) Water Chemistry Guidelines, consistent with the GALL Report aging management program (AMP) XI.M2, "Water Chemistry," to suppress DO levels in the RCS. Further, the applicant's past sampling data from locations throughout the RCS indicate that the DO is maintained below 0.05 ppm, except for rare instances during outage exits (ranging from a few minutes to no longer than a day). The staff noted that, based on NUREG/CR-5704, an assumed DO level below 0.05 ppm gives a transformed oxygen value of 0.26. Based on its review, the staff finds the response acceptable because the applicant amended its LRA to reference the correct value of 0.26 for the transformed oxygen, which is consistent with Equation 8c of NUREG/CR-5704.

The applicant's October 13, 2009, response to Part 3 stated that the maximum fluid temperature observed during cooldown is 210 °F for the decay heat injection piping tee and the transient set included heatup, cooldown, and operating basis earthquake (OBE) cycles. The applicant further stated the baseline unadjusted CUF for this location is 0.00433.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-1, Part 3 acceptable because the applicant provided the information requested, which enabled the staff to verify that the F_{en} and EAF values for decay heat injection piping (stainless steel tee) shown in LRA Table 4.3-3 are accurate.

During its review, the staff identified the need for additional clarifications on F_{en} calculations. For example, in LRA Table 4.3-3 for the component named "Surge line piping up to but not including weld piping next to weld overlays (SS)," the F_{en} value is shown as a range of values instead of a single value for the location. Therefore, the staff issued RAI 4.3.3-2, by letter dated September 11, 2009, requesting that the applicant: (1) specify the F_{en} value used for surge line piping up to but not including weld piping next to weld overlays (SS), (2) provide the source document that specified the extraneous 30,000 power loading and unloading transients in the design basis as indicated in Note 1 for LRA Table 4.3-3, (3) specify the design cycles of the loading-unloading transients and explain why there are 48,000 cycles and 2,600 cycles shown in Note 2 for LRA Table 4.3-3, (4) describe the impact on fatigue results due to the modifications made to transient 22 (HPI test), (5) describe the role that the cited reference NUREG/CR-6717 plays, and (6) summarize the integration method used for F_{en} determination.

The applicant's October 13, 2009, response to Part 1 stated that the CUF of 1.54 reported in the LRA is based on fatigue correction factor (F_{en}) values that varied between 2.55 and 15.35 and a specific F_{en} value cannot be assigned to this CUF since it was obtained by integration of transformed metal service temperatures.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2, Part 1 acceptable because the applicant's integration method calculates the fatigue usage for each stress peak-to-valley per load pair individually based on the F_{en} value for that load pair; the total EAF usage is then the sum of the individual EAF usages. This method is acceptable to the staff because it provides an accurate method for determining the EAF usage factor.

The applicant's October 13, 2009, response to Part 2 stated that the source documents for the extraneous 30,000 power loading and unloading transients in the design basis include the original RV stress report and the current RCS Functional Specification. The applicant stated that the RV stress report evaluation of the outlet nozzle included 48,000 loading and unloading cycles, however, the RV Design Specification and RCS Functional Specification specified only 18,000 loading and unloading cycles. Therefore, the CUF for the RV outlet nozzle was reduced to account for the actual RV Design Specification and RCS Functional Specification of 18,000 loading and unloading cycles.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2, Part 2 acceptable because the applicant clarified that the number of cycles used to calculate the CUF for the RV outlet nozzle used the more appropriate value of 18,000 cycles.

The applicant's October 13, 2009, response to Part 3 stated that the RCS Functional Specification states that the 40-year design basis cycles for power loading and unloading is 18,000 cycles. The applicant further stated that, after reviewing the operating history, the actual number of power loading and unloading transients expected over a 60-year plant life is less than 2,600 cycles and this was used in the EAF evaluations for the surge line.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2, Part 3 acceptable because the applicant explained that the assumed 48,000 cycles described in the original stress report were overly conservative and the staff agrees that the use of 2,600 cycles, resulting from a review of plant operating history, is more realistic for 60 years of plant operation.

The applicant's October 13, 2009, response to Part 4 stated that Transient 22, HPI valve test, includes the periodic testing of the HPI safety injection valves, the HPI suction check valves, and the core flood tank check valve. The applicant stated that the original number of design cycles for the 40-year original plant design life is 40 for the HPI safety injection test and 156 for the HPI suction check valve test. The applicant further stated that the HPI test procedure has been revised and these tests are no longer performed in a manner that impacts the surge line.

The applicant stated that, as of December 2007, it had logged 13 HPI test cycles per HPI valve. Further, the applicant stated that the revised HPI test procedure has the HPI flow test performed during refueling outages with the RV head removed as a prerequisite for performing the HPI test. The applicant stated that the total cycle number for the purpose of the surge line evaluation is 13 versus the design value of 40 since all future testing will be performed without any perturbation of the surge line at temperature. The applicant further stated that the HPI suction check valve test included in Transient 22 does not apply to the surge line and thus, the HPI suction valve tests are reduced from 156 to 0 for the surge line EAF evaluation.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2, Part 4 acceptable because the applicant clarified that, after having recorded 13 test cycles, the HPI flow tests are now performed during refueling outages with the RV head removed, thus there will be no more surge line transients associated with this test, and for the HPI suction valve tests, the cycles are reduced to zero because they do not apply to the surge line.

The applicant's October 13, 2009, response to Part 5 stated that NUREG/CR-6717 was cited in LRA Section 4.3.3 for background information only, because it includes discussions of the F_{en} factors for carbon steels, low alloy steels, and austenitic stainless steels and was published after NUREG/CR-5704 and NUREG/CR-6583. The applicant confirmed that NUREG/CR-6583 was used to determine F_{en} factors for carbon and low alloy steel and NUREG/CR-6909 was used to determine F_{en} factors for austenitic stainless steel.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2, Part 5 acceptable because the applicant used NUREG/CR-6717 in the LRA only as an informational reference and the EAF analyses appropriately used NUREG/CR-6583 and NUREG/CR-6909, consistent with the SRP-LR and the GALL Report recommendations.

The applicant's October 13, 2009, response to Part 6 stated that the response to Part 1 is applicable. The staff found the applicant's response to RAI 4.3.3-2, Part 1 acceptable, as documented above, and since it discusses the analytical steps for F_{en} determination, the staff finds the response to Part 6 acceptable.

LRA Table 4.3-3 shows a F_{en} value of 2.45 being used for all of the locations that use low alloy steels. The staff noted that F_{en} values depend in part on the DO concentration of the reactor water. For low alloy steel and carbon steels, a F_{en} value of 2.45 is only achieved if the DO concentration is maintained at or below a level of 0.05 ppm. The staff noted, although the applicant indicated in the LRA that the DO concentration is historically maintained at or below 0.05 ppm level, the LRA does not provide sufficient information on the reactor water chemistry to support this assumption on the DO concentration. By letter dated September 11, 2009, the staff issued RAI 4.3.3-3 requesting that the applicant: (1) summarize the operating experience in control of DO level in the reactor water since the plant startup and describe all water chemistry programs used, (2) provide a historic summary of the DO level since plant startup, and (3) describe how reactor water samples were taken, including the sampling locations, and justify that the DO data discussed in Part 2 are applicable to all NUREG/CR-6260 locations for the F_{en} calculations.

The applicant's October 13, 2009, response stated that its optimized primary chemistry program meets the requirements shown in the EPRI Water Chemistry Guidelines. The applicant also stated that the optimized primary chemistry program provides programmatic guidance to control primary water chemistry and defines the DO in the RCS to be monitored and the sampling frequencies during all modes of plant operation. The applicant stated that the normal value for DO is less than 5 parts per billion (ppb) (0.005 ppm) and is controlled at levels lower than 5 ppb. The applicant stated that it uses action levels, which define remedial actions to be taken when the RCS DO level exceeds the specified limits. The applicant stated that its records show that between December 31, 1992, and December 5, 2007, the DO level has been maintained below 50 ppb (0.05 ppm) when the RCS temperature is above 250 °F, with the exception of a few instances where the DO level exceeded 100 ppb during Modes 3 and 4 (during outage exits) for a short period of time (ranging from a few minutes to no longer than a day).

However, the applicant did not maintain RCS DO records for the period prior to December 31, 1992. The applicant described its expectation that maintaining an overpressure of hydrogen in the makeup tank and maintaining RCS hydrogen greater than 15 cubic centimeters per kilogram (cm^3/kg) of water would ensure that RCS DO levels would remain less than 5 ppb during the operating period prior to December 31, 1992. The applicant stated that there is no reason to believe that RCS DO levels prior to December 31, 1992, were significantly different from those documented after this date.

The staff noted that the data covers only the period between December 31, 1992, and December 5, 2007, and that for approximately 17.5 years since the plant startup in 1974, DO data was not maintained. The staff reviewed the EPRI chemistry program and finds that a hydrogen concentration above 15 cm^3/kg of water has the ability to suppress the DO level within 50 ppb (0.05 ppm).

By letter dated March 3, 2010, the applicant supplemented its response to RAI 4.3.3-3. The applicant stated that samples are not taken from a single location, but rather they are taken from the RCP suction, the pressurizer liquid sampling, and the makeup and purification demineralizer influent. The applicant stated that hydrogen overpressure in the RCS ensures that oxygen introduced into the system is adequately suppressed to prevent oxidizing conditions. The applicant further stated that the combination of sampling DO and maintaining hydrogen overpressure in the RCS will maintain DO levels as low as reasonably possible throughout the RCS.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-3, as supplemented by letter dated March 3, 2010, acceptable such that the assumptions used in the F_{en} calculations are appropriate. This response is acceptable because the applicant: (1) adequately described its Water Chemistry Program, which is in accordance with EPRI guidelines and GALL AMP XI.M2; (2) provided its historic DO data which demonstrated that levels have been maintained below 0.05 ppm, except in rare instances that occurred during outage exits; (3) samples reactor coolant water from several locations for DO in order to be representative of the chemistry throughout the entire RCS; and (4) maintains hydrogen overpressure, in accordance with EPRI guidelines consistent with GALL AMP XI.M2, in the RCS to scavenge oxygen.

During its audit, the staff noted that the results of a weld overlay application for the surge line hot leg nozzle were unacceptable due to the presence of indications (flaws) in the weld deposit and the overlay weld was removed. The staff also noted that for the surge line pressurizer nozzle, the results of the weld overlay application are acceptable.

The staff noted that the unacceptability of the weld overlay for the surge line hot leg nozzle raises concerns on the validity of the environmentally-adjusted CUF values for the surge line piping up to but not including weld piping next to weld overlays and the surge line hot leg nozzle and stainless steel piping adjacent to weld overlays in LRA Table 4.3-3 because the CUFs of these two locations will be affected by the application of the weld overlay, the removal of the weld overlay, and the reapplication of weld overlay (if this occurs). The staff further noted that any one or a combination of any of these activities causes the stress at the weld overlay and surrounding areas to deviate from the stress state defined in the CLB. By letter dated September 11, 2009, the staff issued RAI 4.3.3-4 requesting that the applicant: (1) describe how the CUFs shown in LRA Table 4.3-3 for the surge line piping up to but not including weld piping next to weld overlays, the surge line hot leg nozzle and stainless steel piping adjacent to weld overlay, and the surge line pressurizer nozzle and stainless steel safe end adjacent to weld overlay were determined; (2) reassess the CUF for the surge line piping up to but not including weld piping next to weld overlays and the surge line hot leg nozzle and stainless steel piping adjacent to weld overlay from LRA Table 4.3-3 when the weld overlay is reapplied; (3) describe the transient set and cycles used for CUF calculations for the three locations identified in Part 1; (4) clarify whether or not a full structural weld overlay for the surge line hot leg nozzle will be reapplied; (5) discuss the purpose of the full structural weld overlay for the pressurizer surge nozzle and the surge line hot leg nozzle; and (6) provide a discussion of any other structural changes made that could affect fatigue results but are not already discussed in the LRA.

The applicant's October 13, 2009, response to Part 1 stated that the environmentally-adjusted CUF values for pressurizer surge line piping up to but not including piping adjacent to the weld overlays was discussed in response to RAI 4.3.3-2. The applicant stated that in fall 2007, the pressurizer surge nozzle and hot leg surge nozzle each received weld overlay applications. However, for the hot leg surge nozzle, the welded-in material was partially removed due to a defect in the weld, the repair was analyzed by AREVA NP, and the conclusions of the structural analysis based on ASME Code Section III for full weld overlay were found to remain applicable to the as-left condition of the hot leg surge nozzle. The applicant also stated that the EAF assessment reported in its LRA for these nozzles has considered the weld overlay repair, the modified hot leg surge nozzle after removal of the weld overlay, and the original analysis of record for the portion of the pressurizer and hot leg surge nozzles not affected by the weld overlay.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 1 acceptable because the analyses have considered the geometric conditions with the full structural weld overlay applied and the condition with the weld overlay partially removed. In the EAF portion of the analysis, the applicant used either the bounding or load-pair specific F_{en} values and followed the procedures described in the response to RAI 4.3.3-2, which is acceptable.

The applicant's October 13, 2009, response to Part 2 stated that the response to Part 1 of this RAI has indicated that the CUF values shown in LRA Table 4.3-3, items 5, 6, and 7 include the effects of the weld overlay.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 2 acceptable because the applicant stated the CUF values shown for items 5, 6, and 7 in LRA Table 4.3-3 include the effects of the weld overlay and, therefore, do not need to be evaluated. Specifically, the applicant has followed the ASME Code Section III, Subsection NB guidelines and applied it to the geometric conditions with the full structural overlay applied and with the weld overlay partially removed to simulate the conditions of the surge line hot leg nozzle repair as well. The analysis demonstrated that the surge line hot leg nozzle as repaired (the configuration with the flaw indication portion ground out) is adequate to perform the intended functions. As shown in the response to Part 4 of this RAI, the applicant has the intention to reapply a full structural weld overlay for the hot leg nozzle.

The applicant's October 13, 2009, response to Part 3 stated that the transient set used for the structural evaluation of the surge line piping, surge line hot leg nozzle (including weld overlay), and pressurizer surge nozzle (including weld overlay) are consistent with the governing NSSS

Design Transients identified in FSAR Table 4-8, with specific modifications for the surge line, hot leg surge nozzle, and pressurizer surge nozzle as described in BAW-2127, Section 4.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 3 acceptable because the applicant clarified that the transient set used for the structural evaluation of the surge line piping, surge line hot leg nozzle (including weld overlay), and pressurizer surge nozzle (including weld overlay) were from its NSSS Design Transients and the surge line stratification and insurge/outsurge transients as described in NRC Bulletin 88-11.

The applicant's October 13, 2009, response to Part 4 stated that the intent is to re-apply a full structural weld overlay for the surge line hot leg nozzle during the next refueling outage.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 4 acceptable because the applicant clarified that the surge line hot leg nozzle will be repaired in the next refueling outage to strengthen the nozzle structure, which has a portion ground out due to flaw indication which occurred during the weld overlay application in the fall of 2007, and the analyses account for the final condition of the adjacent location to this weld.

The applicant's October 13, 2009, response to Part 5 stated that the purpose of the full structural weld overlay for the pressurizer surge nozzle and the surge line hot leg nozzle is for mitigation of primary water stress-corrosion cracking (PWSCC) of the nickel-based Alloy 82/182 welds that connect the carbon steel nozzles to the stainless steel safe ends.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 5 acceptable because the applicant clarified that the intent of the full structural weld overlay was for mitigation of PWSCC of the nickel-based Alloy 82/182 welds. The staff noted that the material deposited to the outer surface of the nozzle, which constitutes the weld overlay, is resistant to PWSCC and has shown the ability to mitigate the PWSCC attack.

The applicant's October 13, 2009, response to Part 6 stated that all structural changes made to the plant from the beginning of plant operation through December 2008 are included in its LRA and changes made to the CLB that occurred during the NRC review of the LRA were evaluated in accordance with 10 CFR 54.21(b).

Based on its review, the staff finds the applicant's response to RAI 4.3.3-4, Part 6 acceptable because the applicant clarified that there are no other structural changes that have not been reported in the LRA and that any future changes during the staff's review will be submitted in accordance with 10 CFR 54.21(b).

LRA Section 4.3.3 states that a bounding F_{en} factor of 1.49 was used for the Alloy 600 component and the method used to determine environmental effects for nickel-based alloy was obtained from H. S. Mehta and S. R. Gosselin, "Environmental Factor Approach to Account for Water Effects in Pressure Vessel and Piping Fatigue Evaluations," Nuclear Engineering and Design, 1998. The staff noted that NUREG/CR-6335, published in 1995, provides the statistical characterizations used to derive this F_{en} factor for Alloy 600 as referenced in the Mehta-Gosselin paper. NUREG/CR-6335 states that the fatigue S-N database for Alloy 600 is extremely limited and does not cover an adequate range of material and loading variables that might influence fatigue life. The staff noted that it further states that the data was obtained from relatively few heats of material and are inadequate to establish the effect of strain rate on fatigue life in air or of temperature in a water environment. The staff noted that NUREG/CR-6909, published in 2007, incorporates more recent fatigue data using a larger database for determining the F_{en} factor of nickel alloys. The staff noted that the reference used in the LRA to determine the environmental effects on nickel alloys may be non-conservative. The staff noted that the incore instrumentation nozzle is the Alloy 600 component of concern. By letter dated May 21, 2010, the staff issued RAI 4.3.3-5 requesting that the applicant: (1) justify using a value of 1.49 for the F_{en} factor for this nickel-alloy component when this factor can vary from 1.0 to 4.52 based on NUREG/CR-6909 methodology and the CUF value may exceed the design limit of 1.0, and (2) describe the current or future planned actions to update the CUF calculation with F_{en} factor for the Alloy 600 component only, consistent with the methodology in NUREG/CR-6909. If there are no current or future planned actions to update the CUF calculation with F_{en} factor for the Alloy 600 component consistent with the methodology in NUREG/CR-6909, the applicant was requested to provide a justification for not performing the update.

The applicant's June 21, 2010, response stated that the environmentally-adjusted CUF was calculated by applying a F_{en} value of 1.49 to the design CUF of 0.58. The applicant stated that the original stress report assumed the material was low alloy steel and used ASME Code Section III, Figure N-415(a) to obtain the allowable number of cycles for the transients. The staff noted that the methodology in Appendix A of NUREG/CR-6909 permits the use of the austenitic stainless steel fatigue design curve for Alloy 600. The staff also noted that Figure A.3 and Table A.2 of NUREG/CR-6909 contains the fatigue design curve for austenitic stainless steels in air and a listing of data points for the new and current ASME Code fatigue design curves for austenitic stainless steels in air, respectively. The applicant stated that it used Figure A.3 and Table A.2 to recalculate the design CUF for this location and it yields an in-air CUF of 0.2055. The applicant further stated that the F_{en} factor was calculated using Equations A.14 through A.17 with a temperature of 579 °F, O* set to 0.16 for PWR water, and ε* selected to maximize the environmental penalty. The staff finds that the applicant's assumptions are reasonable because the bounding values for ε* and O* from NUREG/CR-6909 were used and the temperature value used is bounding for this component.

The staff noted that the resultant environmentally-adjusted CUF is 0.86 when using the Mehta-Gosselin methodology. The applicant stated that the resultant environmentally-adjusted CUF is 0.85 when using the NUREG/CR-6909 methodology. The staff noted that this is less than the value calculated by using the Mehta-Gosselin methodology and is also less than the design limit of 1.0. The applicant also stated that there are no current or future plans to update the CUF calculation consistent with the methodology in NUREG/CR-6909. The staff finds it acceptable that the applicant will not update its CUF calculation consistent with the methodology in NUREG/CR-6909 because it has been demonstrated that the Mehta-Gosselin methodology yields conservative results when compared to the NUREG/CR-6909 methodology for the nickel-alloy incore instrumentation nozzle.

Based on its review, the staff finds the applicant's response to RAI 4.3.3-5 acceptable because the applicant has demonstrated that: (1) the environmentally-adjusted CUF when using the methodology in NUREG/CR-6909 does not exceed the design limit of 1.0 and (2) for the incore instrumentation nozzle fabricated from nickel alloy, the use of a F_{en} of 1.49 is conservative when compared to the methodology in NUREG/CR-6909.

LRA Section 4.3.3 discusses the methodology to determine the locations that require environmentally assisted fatigue analyses consistent with NUREG/CR-6260 "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear power Plant Components." The staff noted that, in LRA Table 4.3-3, there are ten plant-specific locations listed based on the six generic components identified in NUREG/CR-6260. GALL AMP X.M1 states that the impact of the reactor coolant environment on a sample of critical components should include the locations identified in NUREG/CR-6260 as a minimum, and that additional locations may be needed. During its review, the staff was uncertain whether the applicant verified that the plant-specific locations listed in the LRA Table 4.3-3, per NUREG/CR-6260, were bounding for the generic NUREG/CR-6260 components. Furthermore, the staff noted that the applicant's plant-specific configuration may contain locations that should be analyzed for the effects of the reactor coolant environment other than those identified in NUREG/CR-6260. This may include locations that are limiting or bounding for a particular plant-specific configuration, or that have calculated CUF values that are greater than the locations identified in NUREG/CR-6260. Therefore, by letter dated November 29, 2010, the staff issued RAI 4.3.3-6 requesting that the applicant confirm the plant-specific locations listed in LRA Table 4.3-3 are bounding for the generic NUREG/CR-6260 components and that the locations selected for the environmentally assisted fatigue analyses in LRA Table 4.3-3 consists of the most limiting locations for CR-3. Pending receipt and review of the applicant's response, this issue has been identified as **OI-4.3.3-1**.

On the basis of its review, the staff finds disposition of the TLAA for all of the NUREG/CR-6260 components/locations to 10 CFR 54.21(c)(1)(iii) acceptable because it is conservatively managing the effects of aging for these components when considering the effects of reactor water environment.

4.3.3.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of EAF in LRA Section A.1.2.2.10. Based on its review of the FSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the effects of reactor water environment on fatigue.

4.3.3.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3, the staff concludes, pending resolution of OI-4.3.3-1, that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of reactor water environment on fatigue will be adequately managed during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.4 Reactor Coolant System Loop Piping Leak-Before-Break Analysis

4.3.4.1 Summary of Technical Information in the Application

LRA Section 4.3.4 summarizes the evaluation of LBB to the CR-3 RCS main coolant piping for the period of extended operation.

The LRA states that the application of LBB to the CR-3 RCS piping is based on topical report BAW-1847, "The B&W Owners Group Leak-Before-Break Evaluation of Margins Against Full Break for RCS Primary Piping of B&W Designed NSSS," Revision 1, September 1985. The LRA states that this report provides the technical basis to demonstrate that the subject piping satisfies NRC requirements for the LBB application. The LRA states that BAW-1847, Revision 1 also evaluated postulated flaw growth in the main RCS piping (36-inch diameter hot leg piping and 28-inch diameter cold leg piping) under normal plus faulted loading conditions and stated that the NRC approved LBB for the subject piping for the current operating period. The LRA further states that the TLAA in BAW-1847, Revision 1 addresses fatigue flaw growth, and Section 3.3.4.3 of the report includes a qualitative assessment of thermal aging of cast austenitic stainless steel (CASS) RCP inlet and exit nozzles, which is not considered a TLAA. The LRA further states that reduction of fracture toughness by thermal aging of the RCP inlet and exit nozzles was evaluated for license renewal to ensure that the conclusions of the LBB evaluation, reported in BAW-1847, Revision 1, remain valid for the period of extended operation.

The applicant provides a disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(i), that the RCS loop LBB analysis remains valid for the period of extended operation.

Fatigue Flaw Growth. The LRA states that Section 4.3 of BAW-1847, Revision 1 supported the LBB analysis through fatigue growth of a postulated surface flaw to demonstrate that the surface flaws are likely to propagate in the through-wall direction and develop leakage before they will propagate circumferentially around the pipe. The LRA states that this analysis was based on 240 heatup and cooldown cycles and 22 cycles of safe shutdown earthquake for 40 years of operation. The LRA further states that the number of cycles has not been revised for license renewal and are being monitored by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program, which includes corrective actions if a cycle count approaches or exceeds the allowable design limit.

Thermal Aging of Cast Austenitic Stainless Steel Material. The application stated that the susceptibility of the RCS main coolant piping to thermal aging was qualitatively addressed in Section 3.3.4.3 of BAW-1847, Revision 1. The applicant further stated that this report assumed that the fracture toughness of the CASS was assumed to be bounded by that for ferritic piping and ferritic weldments, since there were limited data for CASS available at that time. The application describes that data from Argonne National Laboratory (ANL) in NUREG/CR-6177, “Assessment of Thermal Embrittlement of Cast Stainless Steels” (May 1994), indicate that the lower-bound toughness for CASS material similar to that at CR-3 (i.e., statically cast CF8M) is below that assumed in BAW-1847, Revision 1 and, therefore, the assumption on toughness for CASS in the report required further evaluation for license renewal.

The LRA describes that a flaw stability analysis was performed using the lower-bound CASS fracture toughness curves from the ANL report to show acceptability of LBB for the RCS main coolant piping for the period of extended operation. The LRA concludes that the results of the analysis demonstrate that the margins for LBB per NUREG-0800, “Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants,” Section 3.6.3, “Leak-Before-Break Evaluation Procedures,” are met.

4.3.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.4, to verify that, for LBB analysis of the RCS main coolant piping, the analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

By letter dated December 12, 1985, the staff approved topical report BAW-1847, Revision 1. The LBB analysis involves two main issues that may be time dependent: (1) thermal aging of the CASS material in RCP nozzles and (2) fatigue flaw growth analyses of the RCS piping. In addition, the staff reviewed the potential impact of two previously reviewed and approved license amendments for power uprate on the subject piping because the power uprate condition may change the loadings on the subject pipe that were not considered in the original LBB analysis. The staff also reviewed the operating experience and current structural integrity of the CR-3 RCS loop piping to determine any degradation precursors for the period of extended operation.

Fatigue Flaw Growth Analysis. In its review of LRA Section 4.3.4, the staff identified a need for clarification. In RAI 4.3.4-3, dated August 20, 2009, the staff requested that the applicant clarify the transient cycle count in the flaw growth evaluation in BAW-1847, Revision 1. The staff further requested that the applicant demonstrate the validity of the flaw growth calculations for the period of extended operation in terms of transient cycles used and describe the corrective actions that will be taken when the transient cycles approach the design limit.

The applicant's September 18, 2009, response to RAI 4.3.4-3 stated that the time-limited assumption associated with the RCS loop piping LBB analysis is the number of transients defined for 40 years of operation (240 heatup and cooldown cycles and 22 cycles of safe shutdown earthquake). The applicant stated that it had evaluated the transients defined in the RCS design specification for license renewal, according to 10 CFR 54.21(c)(1)(i), and found that the analysis remains valid for the period of extended operation. As such, there are no new aging concerns associated with the extended period of operation relative to the RCS loop piping LBB analysis and no license renewal AMP is required.

The applicant stated further that as of December 31, 2007, CR-3 had experienced 87 heatups and 86 cooldowns, about 36 percent of the transients available in the design specification, in over 31 years of operation. Therefore, the applicant concluded that the 240 design transients available will not be exceeded in 60 years of operation.

As described in LRA Section 4.3.4, the applicant also identified that it has implemented the Reactor Coolant Pressure Boundary Fatigue Monitoring Program to monitor and track the significant thermal and pressure transients for limiting RCPB components, such that if the number of cycles approach the 40-year design cycles then appropriate corrective actions will be taken.

Based on its review, the staff finds that the fatigue flaw growth calculation of the LBB analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) because the applicant's 40-year design cycles are bounding for 60-years of operation based on the accrued cycles as of December 31, 2007. In additional the applicant stated that the transients that affect this analysis will be monitored and tracked by the Reactor Coolant Pressure Boundary Fatigue Monitoring Program and appropriate actions will be taken in accordance with that program.

Thermal Aging of Cast Austenitic Stainless Steel Material. The summary description of LRA Section 4.3.4 states that the assessment of reduction of fracture toughness by thermal aging of CASS is not considered a TLAA for the LBB analysis.

In RAI 4.3.4-1, dated August 20, 2009, the staff requested that the applicant clarify why the assessment of reduction of fracture toughness by thermal aging of CASS is not a TLAA because the RCP casings and nozzles are made of CASS, which is susceptible to thermal embrittlement.

The applicant's September 18, 2009, response to RAI 4.3.4-1 referenced BAW-1847, Revision 1, Section 3.3.4.3, "Review of Material Properties Thermal Stability (Aging Sensitivity)," which states that, although the degradation in fracture toughness properties reported for CASS materials is large relative to their initial values, the aged condition values are acceptable for the LBB analyses described in the report. Therefore, the report concluded that it is unnecessary to further consider the effects of thermal aging on material properties of CASS.

The staff finds that the applicant's response did not resolve the concern as to why thermal aging of CASS is not a TLAA, particularly since the application describes an analysis using lower-bound CASS fracture toughness data to show acceptability of LBB for the period of extended operation. Therefore, the staff held a teleconference with the applicant on November 22, 2010, to discuss the disposition of CASS RCP casings and nozzles. During the teleconference the applicant stated that they would provide a disposition for the CASS RCP casings and nozzles under 10 CFR 54.21(c)(1)(ii). Pending receipt and review of the applicant's additional information, this issue has been identified as confirmatory item (CI) **CI-4.3.4.2-1**.

LRA Section 4.3.4, page 4.3-14, second paragraph states that, "The fracture toughness curve of the lower-bound CASS material is below the fracture toughness curves used in the RCS piping LBB analysis." Therefore, the assumption in BAW-1847, Revision 1 that the fracture toughness of the ferritic piping and ferritic weldments bounds the fracture toughness of CASS required further evaluation for license renewal. In RAI 4.3.4-4, dated August 20, 2009, the staff requested that the applicant explain the above statement and provide the fracture toughness of the piping used in the LBB analysis and the lower-bound fracture toughness of CASS material of the RCP casing.

The applicant's September 18, 2009, response stated that fracture toughness curves for the ferritic base metal and ferritic weld metals used in the RCS piping LBB analysis were compared to the lower-bound fracture toughness curves of CR-3 RCP CASS materials (i.e., statically cast CF8M) from NUREG/CR-6177. The fracture toughness curve of the lower-bound CASS material is below the fracture toughness curves used in the RCS piping LBB analysis for the ferritic materials. The applicant stated that because the fracture toughness of the CASS is lower than the fracture toughness of the ferritic piping and ferritic weldments evaluated in BAW-1847, Revision 1, it could not be concluded that thermal embrittlement of CASS had been adequately evaluated for the period of extended operation and required further evaluation. The use of the term bounding in the LRA refers to the fracture mechanics evaluation reported in BAW-1847, Revision 1, which was not bounding for the RCP CASS nozzle material relative to safety margins on loads and safety margins on flaw sizes due to the reduction of fracture toughness of CASS by thermal embrittlement.

The applicant clarified that the fracture toughness of the ferritic materials and the lower-bound fracture toughness of CASS material of the RCP casing nozzle, per NUREG/CR-6177, is provided in Sections 4.2.3.1 and 4.2.3.2, and Figure 4-1 of AREVA NP proprietary document 51-9078492-000, "CR-3 Reconciliation of RCP Nozzle LBB Analysis for License Renewal (non-proprietary)."

The staff noted that BAW-1847, Revision 1 only analyzes piping which is made of low alloy steel (ferritic material) and welds which use nickel-based Alloy 82/182 and stainless steel filler metal. BAW-1847 did not analyze RCP casings and nozzles; therefore, the thermal aging of CASS was not considered. The staff finds that BAW-1847 is deficient in analyzing thermal aging of CASS material in RCP nozzles. However, AREVA performed a reconciliation analysis and compared the fracture toughness among RCP nozzles, RCS piping, and associated welds. AREVA found that the lower-bound fracture toughness of the RCP nozzles is more limiting than the fracture toughness of pipe and welds. As discussed above, AREVA evaluated RCP nozzles using the lower-bound fracture toughness and the RCP nozzles satisfy the safety margins of NUREG-0800, Section 3.6.3. Therefore, the staff's concern described in RAI 4.3.4-1 is resolved.

The staff performed an independent calculation of the fracture toughness using the lower-bound and saturation methods in NUREG/CR-6177. The staff finds that the lower-bound fracture toughness used in the AREVA NP report is reasonable. In addition, the staff finds that the applicant has demonstrated that the RCP casing nozzles satisfy the safety margins of NUREG-0800, Section 3.6.3 based on a lower-bound fracture toughness value. Therefore, thermal aging of CASS will not affect the structural integrity of the RCPs and the AREVA NP report 51-9087932-000 demonstrates validity of the LBB analysis for the period of extended operation.

In addition to the thermal aging analysis, the staff also had questions about the inspections of the CASS material. By letter dated May 19, 2000, Christopher I. Grimes of the NRC forwarded to Douglas J. Walters of Nuclear Energy Institute an evaluation of thermal aging embrittlement of CASS components (ADAMS Accession No. ML003717179). The staff's evaluation provided its positions on how to manage CASS components. In RAI 4.3.4-2, dated August 20, 2009, the staff requested that the applicant clarify how the CASS RCP casings satisfy the staff's positions in its evaluation dated May 19, 2000, and discuss how the structural integrity of the RCP casings will be maintained during the period of extended operation.

The applicant's September 18, 2009, response stated that the staff's position on thermal aging embrittlement of CASS RCP casings is incorporated in the GALL Report, Volume 2 on page XI M-50, which states that, for all pump casings and valve bodies greater than nominal pipe size (NPS) 4 inches, the existing ASME Code Section XI inspection requirements, including the alternative requirements of the ASME Code Case N-481 for pump casings, are adequate. The applicant's response also stated that the "Aging Management Program (AMP)" column on Page IV.C2-4 for item IV.C2-6 of the GALL Report, Revision 1, Volume 2 states that screening for susceptibility to thermal aging is not necessary for pump casings and valve bodies. Further, the response stated that the ASME Code Section XI inspection requirements are sufficient for managing the effects of loss of fracture toughness due to thermal aging embrittlement of CASS pump casings and valve bodies.

The applicant stated that SRP-LR Table 3.1.1, item 55, page 3.1-32 indicates that Class 1 pump casings being managed by inservice inspection (ISI) for loss of fracture toughness due to thermal embrittlement do not require further evaluation. As indicated on row 3 of page 3.1-106 of the LRA, CR-3 manages loss of fracture toughness due to thermal embrittlement of the RCP casings with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. This item is aligned with GALL Report item IV.C2-6 that corresponds to LRA Table 1, item 3.1.1-55 (page 3.1-24) and has been assigned a standard note A (page 3.1-144 of the LRA) to indicate that, "Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP." Therefore, by adopting the aging management strategy of the GALL Report, the intended functions of RCP casings will be maintained consistent with the CLB during the period of extended operation.

The staff finds that to manage the thermal aging of RCP casings, the applicant will follow the guidance in the staff's letter dated May 19, 2000, by adhering to the requirements in the ASME

Code Section XI, SRP-LR, and the GALL Report. Based on its review, the staff finds the applicant's response to RAI 4.3.4-2 acceptable.

Impact of Power Uprate. The staff approved two power uprate applications for CR-3 in 2002 and 2007. In RAI 4.3.4-5, dated August 20, 2009, the staff requested that the applicant discuss the impact of the power uprates on the results of BAW-1847, Revision 1 in terms of fatigue flaw growth evaluation, thermal aging of CASS RCP nozzles, flaw stability analysis, and safety margins in NUREG-0800, Section 3.6.3.

The applicant's September 18, 2009, response stated that in support of power uprate applications in 2002 and 2007, AREVA NP, Inc., reviewed the impact of CR-3 uprated plant conditions relative to the analytical assumptions in BAW-1847, Revision 1, as described in the license amendment requests for the power uprates. The applicant stated that these evaluations determined that the impacts of the 2002 and 2007 power uprate design conditions on the inputs to the LBB analyses were negligible, and the LBB conclusions remained unchanged. Specifically, the applicant stated that the evaluations demonstrate that the CR-3 RCP nozzle loads used for the LBB analysis bound those after the two power uprates.

Based on its review of the applicant's response, the staff finds that the power uprate conditions do not affect the LBB analysis and, therefore, finds the applicant's response to RAI 4.5.4-5 acceptable.

Operating Experience of LBB-Approved RCS Piping at CR-3. In RAI 4.3.4-6, dated August 20, 2009, the staff requested that the applicant identify flaws that have remained in service in the LBB-approved RCS piping, discuss how the flaws will be monitored during the period of extended operation, and discuss the flaw growth evaluations of these flaws.

The applicant's September 18, 2009, response to RAI 4.3.4-6 stated that the piping in the scope of the LBB analyses at CR-3 has been inspected in accordance with the requirements of the approved ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program since initial plant operation and will continue to be subject to the inspection requirements of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program through the period of extended operation. The applicant reviewed nuclear condition reports and did not find unresolved reportable indications or flaws associated with LBB piping.

The staff finds the applicant's response to RAI 4.3.4-6 acceptable because the applicant has identified no flaws that could affect its LBB analyses.

The staff noted that PWR plants have experienced PWSCC in Alloy 82/182 dissimilar metal welds in the ASME Class 1 piping. PWSCC has an aggressive crack growth rate and is an active degradation mechanism in PWRs. One of the conditions for continued approval of LBB is that active degradation mechanisms, such as PWSCC, cannot be present. In RAI 4.3.4-7, dated August 20, 2009, the staff requested that the applicant: (a) identify all Alloy 82/182 dissimilar metal welds in the LBB-approved RCS piping; (b) discuss the actions that have been or will be taken to mitigate and/or inspect these Alloy 82/182 welds to ensure that PWSCC will not affect the structural integrity of the LBB-approved RCS piping during the period of extended operation; (c) discuss the inspection history, including results, methods used, and examination volume coverage, of the Alloy 82/182 weld material in the RCS piping; and (d) discuss the inspection history of other welds in the LBB piping.

The applicant's September 18, 2009, response to RAI 4.3.4-7, Part a, identified that there are a total of eight Alloy 82/182 dissimilar metal welds that are associated with large bore RCS piping within the scope of LBB and BAW-1847, Revision 1. The response stated that a forged stainless steel transition piece is installed in each line between the CASS RCP and the carbon steel pipe, and Alloy 82/182 welds join the forged stainless steel transition piece to the carbon steel RCS piping.

In response to Part b, the applicant stated that from original plant startup through the 2003 refueling outage, the traditional ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program was used, including all three periods of the first and second 10-year inspection intervals and the first period of the third 10-year inspection interval. The CR-3 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program required 100 percent of the eight ASME Code Category B-F welds to be surface-examined and volumetrically-examined during each 10-year inspection interval.

The response stated that the CR-3 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program was changed to a risk-informed program beginning with the middle of the second period of the third inspection interval, and the NRC approved the CR-3 Risk-Informed Inservice Inspection (RISI) Program under relief request 07-001-11 in September 2005. The response further stated that RISI was implemented for examinations in the second period of the third 10-year inspection interval, which began with the 2005 refueling outage. The response identified that the RISI Program characterizes the previous Category B-J and Category B-F welds as Category R-A, medium risk Category 4 welds.

The applicant further stated that these eight Alloy 82/182 welds are subject to minimum examination requirements from the "EPRI Materials Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guidelines (MRP-139)," with the initial MRP-139 volumetric examinations required to be completed no later than December 31, 2010. The applicant further stated that subsequent volumetric and bare metal visual examinations are performed as specified in MRP-139, Tables 6-1 and 6-2. From Table 6-1, the applicant stated that PWSCC Category E is appropriate for these Alloy 82/182 welds, and the volumetric inspection requirement is once every 6 years. The applicant further stated that Table 6-2, PWSCC Category K, specifies the frequency for visual inspections as once every three refueling outages.

According to the applicant, the CR-3 ASME Section XI ISI Program specifies examinations of these Alloy 82/182 welds in accordance with these MRP-139 requirements. Further, the applicant stated that, in accordance with the current ISI Program plan, the MRP-139 requirements are independent from the RISI Program and these examinations will be performed in addition to the RISI Program examinations, unless dual crediting can occur for single examinations which meet the individual requirements of both the RISI Program and MRP-139.

The applicant further stated that any future mitigation actions would be in accordance with license renewal Commitment No. 2, which states:

> In accordance with the guidance of the GALL Report, Revision 1, regarding aging management of nickel alloy and nickel-clad components susceptible to PWSCC, CR-3 will comply with applicable staff orders and will implement applicable: (1) bulletins and generic letters and (2) staff-accepted industry guidelines.

The applicant's response to Part c provided the following inspection results for the past five refueling outages as follows:

Refueling Outage	Year	Number of Volumetric Exams	Exam Coverage	Number of Visual Exams	Number of Surface Exams	Results
11	1999	1	> 90	0	1	Satisfactory
12	2001	0	Not applicable	0	0	Not applicable
13	2003	0	Not applicable	0	0	Not applicable
14	2005	4	> 90	4	0	Satisfactory
15	2007	0	Not applicable	4	0	Satisfactory

The applicant's response to Part d referred to its response to RAI 4.3.4-6, which stated that the piping within the scope of the LBB analyses at CR 3 has been inspected in accordance with the requirements of the approved ASME Section XI ISI program since initial plant operation, and the applicant did not find unresolved reportable indications or flaws associated with LBB piping.

The staff finds that the applicant has performed examinations of the eight Alloy 82/182 dissimilar metal welds in accordance with the ASME Code Section XI requirements and industry guidance (i.e., MRP-139). The staff finds that the applicant has followed the necessary ASME required ISI requirements to monitor the structural integrity of the RCS loop piping, which has been maintained in good condition. Further, the applicant will continue to perform inspections consistent with ASME Code and NRC requirements. On this basis, the staff finds the response to RAI 4.3.4-7 acceptable.

The staff noted that the industry guidance in MRP-139 has been incorporated in ASME Section XI Code Case N-770. The staff proposed incorporating Code Case N-770 into 10 CFR 50.55a in a proposed rulemaking, for which the final rulemaking is pending. Once the Code Case N-770 is incorporated in 10 CFR 50.55a all PWR licensees, including the applicant, will be required to follow 10 CFR 50.55a for the augmented examination of Alloy 82/182 welds. The augmented examination requirements will be applicable through the period of extended operation.

The staff concludes that the fatigue flaw growth calculation in BAW-1847, Revision 1 remains valid for the period of extended operation. For the thermal aging of the CASS RCP nozzles, the original LBB analysis is not valid for the period of extended operation. However, AREVA report 51-9087932-000 shows that thermal aging of RCP casings and nozzles has been analyzed satisfactorily and that the RCP nozzles satisfy the safety margins of NUREG-0800, Section 3.6.3 for the period of extended operation. The structural integrity of the RCS piping is maintained and monitored in accordance with the ASME Code Section XI. On the basis of its LBB analysis and inspections, the staff concludes that the applicant provided reasonable assurance that the LBB-approved RCS piping will perform its intended function during the period of extended operation.

4.3.4.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of the LBB analysis for the reactor coolant loop piping in LRA Section A.1.2.2.11. On the basis of its review of the FSAR supplement in LRA Section A.1.2.2.11, the staff concludes that the summary description of the applicant's actions to address the TLAA for the LBB analysis of the subject piping is adequate.

4.3.4.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.3 pending resolution of CI-4.3.4.2-1, the staff concludes that, pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that the fatigue flaw growth calculation of the reactor coolant loop piping in BAW-1847, Revision 1, remains valid for the period of extended operation and that the thermal aging of RCP casings and nozzles of the reactor coolant loop piping, as analyzed in AREVA report 51-9087932-000, remain valid for the period of extended operation. Pursuant to 10 CFR 54.21(c)(1)(ii), the staff concludes that the applicant has demonstrated that the analysis of thermal aging of CASS RCP suction and discharge nozzles has been projected to the end of the period of extended operation. The FSAR supplement contains an appropriate summary description of the TLAA evaluation of the subject LBB piping, as required by 10 CFR 54.21(d).

4.4 10 CFR 50.49 Thermal, Radiation, and Cyclical Aging Analyses

The environmental qualification requirements established by 10 CFR Part 50, Appendix A, Criterion 4 and 10 CFR 50.49 specifically require each applicant to establish a program to qualify electrical equipment so that such equipment, in its end of life condition, will meet its performance specifications during and following design basis accidents. The 10 CFR 50.49 environmental qualification (EQ) program is a TLAA for purposes of license renewal. The TLAA of the EQ of electrical components includes all long-lived, passive, and active electrical and instrumentation and control (I&C) components that are important to safety and are located in a harsh environment. The harsh environment includes those areas subject to environmental effects caused by loss-of-coolant accidents (LOCAs), high-energy line breaks (HELBs), and post-LOCA environments.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (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.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4, "Environmental Qualification of Electrical Equipment," summarizes the applicant's evaluation of EQ of plant electrical and I&C components for the period of extended operation. The CR-3 Environmental Qualification (EQ) Program is an existing program established to manage CR-3 component thermal, radiation, and cyclical aging based on 10 CFR 50.49 requirements. The applicant stated that the Environmental Qualification (EQ) Program manages component thermal, radiation, and cyclic aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The applicant also stated that as required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the age limits established in the evaluation. The applicant further stated that equipment qualification evaluation for EQ components that specify qualification of at least 40 years are

TLAAs for license renewal. The applicant stated that in accordance with 10 CFR 54.21(c)(1)(iii), the Environmental Qualification (EQ) Program, which implements the requirements of 10 CFR 50.49, is viewed as an AMP for license renewal. The applicant further stated that reanalysis of an aging evaluation to extend the qualification of components is performed on a routine basis as part of the Environmental Qualification (EQ) Program. The applicant stated that important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). Under the Environmental Qualification (EQ) Program, the applicant confirmed that if the qualification cannot be extended by reanalysis, the component must be refurbished, replaced, or prequalified prior to exceeding the period for which the current qualification remains valid.

The applicant concluded that continued implementation of the Environmental Qualification (EQ) Program provides reasonable assurance that the aging effects will be managed and EQ components will continue to perform their intended functions for the period of extended operation and provided a disposition of 10 CFR 54.21(c)(iii) for this TLAA.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4, program basis documents, and interviewed plant personnel to determine if the applicant's Environmental Qualification (EQ) Program meets the requirements of 10 CFR 54.21(c)(1). The applicant's Environmental Qualification (EQ) Program is implemented per the requirements of 10 CFR 54.21(c)(1)(iii) to show that components evaluated under the applicant's TLAA evaluation will be adequately managed during the period of extended operation. The staff reviewed the applicant's Environmental Qualification (EQ) Program's conformance to the requirements of 10 CFR 50.49, including the management of aging effects, to confirm that electric components requiring EQ will continue to operate consistent with the CLB during the period of extended operation.

The staff also conducted a review of the AMP information provided in LRA Section B.3.2 and the program basis documents provided to the staff during the audit. Based on the staff's review of LRA Section B.3.2, including audit results, the staff concludes that the applicant's Environmental Qualification (EQ) Program elements are consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

Therefore, the staff finds that the applicant's Environmental Qualification (EQ) Program demonstrates, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The applicant's Environmental Qualification (EQ) Program is, therefore, capable of managing the qualified life of components within the scope of the program for license renewal and that the continued implementation of the Environmental Qualification (EQ) Program provides assurance that the aging effects will be adequately managed and that electrical equipment will continue to perform its intended function(s) for the period of extended operation.

4.4.3 FSAR Supplement

In LRA Appendix A, Section A.1.2.3, the applicant provided an FSAR supplement summary description of its TLAA evaluation of the EQ of electrical equipment TLAA. On the basis of its review, the staff concludes that the information in the FSAR supplement is consistent with GALL

AMP X.E1 and SRP-LR Table 4.4-2. The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

4.4.4 Conclusion

On the basis of its review of the applicant's Environmental Qualification (EQ) Program, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging will be adequately managed for the EQ of electrical equipment TLAA so that the intended function(s) will be maintained for the period of extended operation. The staff also reviewed the FSAR supplement and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress Analyses

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 provides a summary of the evaluation of the concrete containment tendon prestress analysis for the period of extended operation for CR-3. The applicant stated that the CR-3 reactor building consists of a prestressed, reinforced concrete cylinder and a hemispherical dome. The applicant further stated that the containment is prestressed using a two-way, post-tensioning system with 282 horizon (hoop) tendons and 144 vertical tendons for the cylinder wall and a system of 123 three-way tendons for the dome. The applicant stated that prestressing tendons tend to lose their prestressing forces with time due to creep and shrinkage of concrete and relaxation of the prestressing steel. The applicant identified loss of tendon prestress as a TLAA and evaluated the adequacy of the prestressing forces for the period of extended operation.

The applicant stated that there have been eight tendon surveillance tests since the CR-3 plant started operation in December 1976. The applicant further stated that, since 1997, these tests have been performed under the ASME Section XI, Subsection IWL Program, which inspects a sample of tendons from each category (i.e., dome, vertical, and hoop) and calculates the regression analysis trend lines of these three groups based on individual tendon forces. The applicant stated that this regression analysis is consistent with NRC Information Notice 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," that is, using individual-tendon data rather than averages and using all prior test data. The applicant stated that the program confirms that the acceptance criteria have been met and that the tendon prestress will remain above minimum required values for the succeeding inspection interval.

The applicant stated that, for the purposes of extending the CR-3 plant operating license, regression analysis was used to extrapolate the tendon prestress forces to the end of the period of extended operation, which would be in the 63rd year from the date of initial tensioning. The applicant presented the overall results of the regression analysis for the three groups of tendons in a series of tables and figures that included the data from tendon surveillances and the projected tendon force at the end of the period of extended operation.

The applicant stated that, in accordance with 10 CFR 54.21(c)(1)(ii), the TLAA evaluation projected the trend line of tendon prestress forces to the end of the period of extended operation

(60-year service period) for each group of tendons. For each group of tendons, the projected prestress force value exceeds the minimum required value for prestressing force. Therefore, the applicant concluded that the prestress in all three groups of tendons will remain above the applicable minimum required values for the period of extended operation and the tendons will perform their intended function.

4.5.2 Staff Evaluation

The staff reviewed LRA Section 4.5 to determine if the applicant's TLAA for concrete containment tendon prestress meets the requirements of 10 CFR 54.21(c)(1)(ii).

During its review, the staff identified a discrepancy in this section. Specifically, the fourth column of the first row in LRA Table 4.5-1, "Summary of Tendon Data," lists the tendon force value extrapolated to the end of the period of extended operation for dome tendons as 1,255 kips. However, in LRA Figure 4.5-1, "Projected Force in Dome Tendons," the trend line based on individual lift-off forces from surveillance data indicates that the projected lift-off force in the dome tendons at the end of the period of extended operation (i.e., 63 years after initial tensioning) would be approximately 1,330 kips. In RAI 4.5-1, dated September 22, 2009, the staff requested that the applicant explain the discrepancy between the projected tendon force values at the end of the period of extended operation in the dome tendons indicated in LRA Table 4.5-1 and Figure 4.5-1, and identify the correct value.

The applicant's October 22, 2009, response provided revised LRA Tables 4.5-1, "Summary of Tendon Data;" 4.5-2, "Dome Tendon Data"; 4.5-3, "Vertical Tendon Data"; and 4.5-4, "Hoop Tendon Data." These revised tables presented results that included data from the first and second interval surveillance tests in the tendon prestress regression analysis that were not included in the original LRA tables and figures. Based on the regression analysis of measured lift-off forces from all previous surveillances, the applicant summarized, in the revised LRA Table 4.5-1, the tendon force values extrapolated to the end of the period of extended operation to be 1,321 kips, 1,484 kips, and 1,328 kips for dome, vertical, and hoop tendons, respectively. In comparison, the minimum required tendon force values were reported as 1,215 kips, 1,149 kips, and 1,252 kips for dome, vertical, and hoop tendons, respectively. The applicant stated that the computed projected values demonstrate that prestress in all three groups of tendons should remain above the applicable minimum required values for the period of extended operation and that the tendons should maintain their design basis function.

The response further stated that CR-3 will evaluate the need to revise the technical response to this RAI at a later date as a result of the October 2009 delamination event of the containment structure. This finding is the subject of Event Notification 45416, dated October 7, 2009, and NRC Special Inspection Team Press Release No. 11-09-055, dated October 9, 2009. The applicant stated that this evaluation will be completed following the root cause determination and subsequent assessment of any impact on the technical programs and AMPs discussed in this response.

The staff has determined that TLAA 4.5 should remain as a part of the generic containment delamination Open Item(OI) **OI-3.5-1**, pending the applicant's submittal of updated or revised tendon TLAA information, upon completion of its evaluation of the TLAA, with consideration of the CR-3 containment delamination repair project that is currently in progress.

4.5.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of the concrete containment tendon prestress in LRA Section A.1.2.4. On the basis of its review of the FSAR supplement, the staff concludes that the summary description of the applicant's actions to address concrete containment tendon prestress will be affected by the containment delamination event of October 2009. Therefore, the applicant will need to provide an updated FSAR supplement to reflect the latest prestressing tendon information, as a result of the repair of the containment delamination event of October 2009 that is currently in progress. Therefore, the FSAR supplement associated with TLAA 4.5 will also remain as part of open item OI-3.5-1.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the information presented in LRA Section 4.5 with regard to the containment prestress TLAA and the associated FSAR supplement in LRA Section A.1.2.4 will be impacted, as a result of the CR-3 containment delamination event of October 2009, for at least the vertical tendons and hoop tendons. Therefore, the staff concludes that TLAA 4.5 and its associated FSAR supplement should remain open as part of **OI-3.5-1**, pending the applicant's submittal of updated or revised tendon TLAA information, upon completion of its evaluation of the TLAA, with consideration of the CR-3 containment delamination repair project that is currently in progress.

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

4.6.1 Summary of Technical Information in the Application

LRA Section 4.6 summarizes the evaluation of fuel transfer tube expansion bellows analyses for the period of extended operation.

In LRA Section 4.6.1, the applicant stated that the fuel transfer tubes are essentially tubular passageways that connect the fuel transfer canal in the reactor building to the spent fuel pool located in the auxiliary building. The applicant also described that the expansion bellows connect the fuel transfer tubes to the refueling canal in the reactor building and to the spent fuel pool in the auxiliary building.

The application stated that the expansion bellows are designed and fabricated to the requirements of the ASME Code Section VIII and are inspected in accordance with the requirements of the ASME Code Section III, Class B vessels. The applicant further stated that each expansion bellows is designed to withstand a minimum of 5,000 cycles of expansion and contraction cycles over a lifetime of 40 years of operation, and these design analyses are, therefore, fatigue TLAAs in accordance with 10 CFR 54.3, requiring evaluation for the period of extended operation.

To determine if the design analyses remain valid through the end of the period of extended operation, the applicant projected the number of cycles for 60 years of operation. The applicant stated that expansion bellows thermal cycles occur during each refueling outage when the fuel transfer tubes are flooded with refueling water and then drained when the plant is returned to normal operation. The applicant assumed a period of mid-loop operation that involved a partial drain and refilling of the canal. The applicant stated that expansion bellows cycling would, therefore, occur twice during each refueling operation. However, the applicant assumed thermal cycling to occur three times during each refueling cycle. The applicant also assumed that the number of cycles experienced by the expansion bellows in the auxiliary building is the same as the number of cycles experienced by the expansion bellows in the reactor building. The applicant assumed 19 refueling outages over the 40-year life of the plant and 29 refueling outages for a 60-year operating period. The maximum number of operating cycles over 60 years of operation is, therefore, projected to be 87 cycles by the applicant.

The applicant provided a disposition of this TLAA, in accordance with 10 CFR 54.21(c)(1)(i), that the analysis will remain valid for the period of extended operation.

4.6.2 Staff Evaluation

The staff reviewed LRA Section 4.6 to verify that the analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

In LRA Section 4.6, the applicant stated that the fuel transfer tube expansion bellows were designed for a life of 5,000 cycles. The applicant also estimate+d the number of thermal cycles that the expansion bellows will experience, projected to the end of the period of extended operation, as 87. The ASME Code Section VIII fatigue design criterion for bellows requires that the number of operating cycles be less than the number of design cycles. The number of 87 cycles over the life of the plant as compared to 5,000 design allowable cycles meets this criterion and is, therefore, acceptable. Therefore, the fuel transfer tube expansion bellows fatigue TLAAs remain valid for the period of extended operation and have been appropriately dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of fuel transfer tube expansion bellows in LRA Section A.1.2.5.1. Based on its review of the FSAR supplement, consistent with SRP-LR Section 4.6.3.2, the staff concludes that the applicant provided an adequate summary description of its actions to address the TLAA for fuel transfer tube expansion bellows.

4.6.4 Conclusion

On the basis of its review consistent with SRP-LR Section 4.6, the staff concludes that the applicant has demonstrated that for fuel transfer tube expansion bellows, the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7 <u>Other Plant-Specific Time-Limited Aging Analyses</u>

4.7.1 Summary of Technical Information in the Application

In LRA Section 4.7.1, the applicant discussed the CR-3 Bedrock Solutioning Study, which is documented in FSAR Section 2.5.3.4. The applicant stated that the solutioning process is the result of fresh water entering the underground areas below the plant and attacking the limestone sediments, causing a destructive alteration of the carbonate rock, leaving a labyrinth of channels throughout the rock mass. The applicant stated that this study was performed to determine the rate at which the solutioning process takes place and to establish the effect of such solutioning on the foundation of the CR-3 power plant during its 40-year life. The applicant stated that the study involved the determination of the percent of rock dissolved over the 40-year life of the plant by using different methods. The applicant found from the results of this study that the percent of rock dissolved represents an insignificant amount. In addition, the applicant found that the small percentages of bedrock solutioning remain insignificant to the stability of the rock mass existing beneath the plant foundation, even when considering the extended 20-year period of operation.

LRA Section 4.7.1 states that the results of the exploratory drilling and the grout hole drilling indicate that the volume of solution channels probably does not exceed 15 percent of the rock mass. Assuming the law of uniformitarianism to be true, the applicant stated that the aforementioned 15 percent of the rock mass (determined by the drilling and the grout hole drilling) was dissolved in a period of 40 million years. On this basis, the applicant has determined the solution rate of the limestone to be 15 percent per 40 million years or approximately 3.75×10^{-7} percent per year. In the 40-year life of a plant, an additional 1.5×10^{-5} ($40 \times 3.75 \times 10^{-7}$) percent could be expected to be dissolved.

In addition, the FSAR considered an extreme case by assuming that all of the aforementioned solutioning has occurred during the last 10,000 years after the base level of the limestone formation was established as it essentially is today. This calculation produces the maximum solution rate. Assuming that only 10,000 years have been required for 15 percent of the rock mass to dissolve, the solution rate is 1.5×10^{-3} percent per year. In a 40-year life of the plant, 6×10^{-2} percent ($40 \times 1.5 \times 10^{-3}$ percent) of the total volume would be dissolved. The FSAR states that such a small percentage of solutioning would still be insignificant to the stability of the rock mass. To determine the percent dissolved during a 60-year plant life, this value was multiplied by the 60/40 ratio, thus obtaining a dissolution of 6×10^{-2} percent x 60/40 = 9×10^{-2} percent.

The applicant provided a disposition of this TLAA, in accordance with 10 CFR 54.21(c)(1)(ii), that the analysis has been projected to the end of the period of extended operation.

4.7.2 Staff Evaluation

The staff reviewed LRA Section 4.7.1 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. The staff reviewed FSAR Section 2.5.3.4 and determined that the applicant has adequately reported that the results of the subsurface data obtained from exploration and drilling of the foundation for Crystal River Unit 2 showed that the solutioning process was most intense in the first 100 feet of the section below the existing ground surface at the site. FSAR Section 2.5.3.4 also states that because of the geochronology of the area, the applicant considered the age of the solution sediments to be 40 million years which was used in one of the 2 methods discussed in the LRA.

Another method of evaluating bedrock dissolution is provided in the FSAR. This method determined that 4×10^{-3} percent of the bedrock would be dissolved over the 40-year life of the plant. This was based on information obtained from the U.S. Geological Survey (USGS) for dissolved solids over a large land area that included the CR-3 site. Using this information, it was determined that 764 lbs/day per square mile was dissolved. Comparing this to the actual area of the power plant resulted in 6.3 lbs per day of dissolved solids, daily, beneath the plant. This, in turn, results in 23 cubic feet (cft) of limestone per year dissolved from 23,040,000 cft of rock based on limestone density of 100 pounds per cubic feet (lbs/cft) and assuming the solutioning occurs in the first 100 feet of depth beneath the ground surface. The conclusion of this analysis was that the solution rate was 1×10^{-4} percent per year or 4×10^{-3} percent for 40 years. For an additional 20 years of extended life, the total maximum volume of dissolved bedrock was determined by multiplying by 60/40: 4×10^{-3} percent x 60/40 = 6×10^{-3} percent.

It should be noted that the FSAR states that the above information supporting the calculations was obtained through verbal communication with Mr. R. D. Cherry (USGS). Mr. Cherry stated in a recent teleconference with the staff that recent studies indicate that within an area of infiltration of 720 square miles, including the area of the plant site, a total of 243 tons per day of solids is being dissolved by the solutioning effect of groundwater. This represents a total of less than ½ ton per day per square mile. Considering that the area of the generating facilities covers approximately 230,400 square feet or 0.0082 square miles, the applicant has calculated the expected quantity of dissolved solids removed from beneath the plant area daily to be approximately 6.3 pounds. Assuming that all of the solutioning will occur in the first 100 feet of depth beneath ground surface and that the unit weight of the limestone is 100 lbs/cft, it follows that 0.063 cft/day or 23 cft/year are dissolved from (230,400 x 100) 23,040,000 cft of rock. This figure represents 1×10^{-4} (23 x 100/23,040,000) percent per year.

Comparing the figures obtained by the above two methods, the percent of the rock dissolved over the life of the plant ranges from 1×10^{-4} to 1.5×10^{-5} percent. To extend this value to 60 years, the applicant multiplied the total maximum projected volume of dissolved bedrock (by one method) in 40 years by the ratio of 60/40 for an additional 20 years of extended life, thus obtaining 1.5×10^{-5} percent x 60/40 = 2.25×10^{-5} percent. A similar calculation using the rate of 1×10^{-4} percent for 40 years gives the percent dissolved in 60 years as 1.5×10^{-4} percent (1×10^{-4} x 60/40). However, it was noted that the applicant did not use the extreme case of reasoning for determining the percent of the rock dissolved at 40 years of plant life in the conclusion for FSAR Section 2.5.3.4 and, therefore, did not use this projection for this TLAA.

The staff verified the applicant's calculations pertaining to the percentage of dissolution of bedrock presented above and found the calculations to be acceptable.

After reviewing the above information, the staff issued RAI 4.7-1, dated August 31, 2009, requesting that the applicant clarify if it has investigated any recent studies made (by USGS or any other entities) on the regional geology that may provide some insight on the subject of bedrock dissolution from groundwater at the CR-3 site. The applicant was requested to report any results of such investigation, since the FSAR only references a verbal communication with R.D. Cherry of the USGS. The applicant's September 30, 2009, response stated that the CR-3 license renewal review did not expand the TLAA to investigate if there were any recent studies on regional geology on the subject of bedrock dissolution from groundwater at CR-3. The applicant indicated that only the CLB information was used to project the dissolved solids removed from beneath the plant area. As noted in the LRA, the USGS information was only one of two analyses considered to determine that bedrock dissolution would not adversely impact the foundation structural integrity for the period of extended operation. In addition, the LRA evaluation included information that the grouting process employed would reduce the permeability of the foundation carbonate rocks by more than a factor of 30. Hence, the staff found that the use of the CLB information for the evaluation of this TLAA was sufficient. Therefore, the staff found that the applicant has adequately projected the amount of dissolved rock mass beneath the power plant foundation for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

4.7.3 FSAR Supplement

The applicant provided an FSAR supplement summary description of its TLAA evaluation of bedrock dissolution from groundwater analysis in LRA Section A.1.2.6.1. On the basis of its review of the FSAR supplement, the staff concludes that the summary description of the applicant's actions to address the amount of dissolved rock mass beneath the power plant foundation is adequate.

4.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for bedrock dissolution from groundwater analysis, the analysis has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for Time-Limited Aging Analyses

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." On the basis of its review, the staff concludes, pending resolution of OI-3.5-1 and CI-4.3.4.2-1, that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3, and that the applicant has demonstrated that: (1) the TLAAs will remain valid through the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) that the effects of aging on intended functions will be adequately managed through the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the FSAR supplement for the TLAAs and finds that the supplement contains sufficient descriptions of the TLAAs to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA-based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB and that any changes made to the CLB, in order to comply with 10 CFR 54.29(a), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR 54), the Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for Crystal River Unit 3 Nuclear Generating Plant (CR-3). The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report (SER) is issued. Florida Power Corporation (the applicant) and the staff of the United States Nuclear Regulatory Commission (NRC or the staff) will meet with the subcommittee and the full committee to discuss issues associated with the review of the LRA.

After the ACRS completes its review of the LRA and SER, the full committee will issue a report discussing the results of the review. An update to this SER will include the ACRS report and the staff's response to any issues and concerns reported.

SECTION 6

CONCLUSION

The staff of the United States Nuclear Regulatory Commission (NRC or the staff), reviewed the license renewal application (LRA) for Crystal River Unit 3 Nuclear Generating Plant (CR-3), in accordance with NRC regulations and NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)," dated September 2005. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) sets the standards for issuance of a renewed license.

The staff's conclusion regarding the LRA for CR-3 is withheld pending resolution of the open and confirmatory items described in this SER.

The staff noted that any requirements of 10 CFR Part 51, Subpart A, will be documented in a plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)."

APPENDIX A

CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT LICENSE RENEWAL COMMITMENTS

During the review of the Crystal River Unit 3 Nuclear Generating Plant (CR-3) license renewal application (LRA) by the staff of the United States Nuclear Regulatory Commission (NRC or the staff), Florida Power Corporation (FPC or the applicant) made commitments related to managing the effects of aging for structures and components (SCs). The following table lists these commitments along with the implementation schedules and sources for each commitment.

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
1	In accordance with the guidance of NUREG-1801, Revision 1, “Generic Aging Lessons Learned (GALL) Report,” regarding aging management of reactor vessel internals components, CR-3 will: (1) participate in the industry programs for investigating and managing aging effects on reactor internals, (2) evaluate and implement the results of the industry programs as applicable to the reactor internals, and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.	A.1.1	December 3, 2014
2	In accordance with the guidance of NUREG-1801, Rev. 1, regarding aging management of nickel alloy and nickel-clad components susceptible to primary water stress corrosion cracking, CR-3 will comply with applicable NRC Orders and will implement applicable: (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	A.1.1	As stated in the Commitment
3	The Reactor Head Closure Studs Program will be enhanced to select an alternate lubricant that is compatible with the fastener material and the contained fluid.	A.1.1.3 B.2.3	December 3, 2016
4	The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program to be implemented. When a Safety Evaluation Report is issued for MRP-227, any required actions that affect the aging management strategy for these components will be incorporated into the program documents.	A.1.1.6 B.2.6	December 3, 2016
5	Program administrative control documents for the Bolting Integrity Program will be enhanced to include: (1) guidance for torquing and closure requirements based on the EPRI documents endorsed by NUREG-1801, (2) requirements to remove instances where molybdenum disulfide lubricant is allowed for use in bolting applications in specific procedures and to add a general prohibition against use of molybdenum disulfide lubricants for bolted connections, (3) guidance for torquing and closure requirements that include proper torquing of the bolts and checking for uniformity of gasket compression after assembly, (4) guidance for torquing and closure requirements based on the recommendations of EPRI NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” (with exceptions noted in NUREG-1339), EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide," and EPRI 5067, “Good Bolting Practices, A Reference Manual for Nuclear Power Plant Personnel,” Volumes I and II, (5) a centralized procedure based on EPRI NP-5769, EPRI TR--104213, and EPRI 5067 containing guidance regarding bolted joint leak tightness and preinstallation inspections consistent with the recommendations of those documents, (6) periodic examinations of a representative sample of bolting identified as potentially having yield strength ≥150 ksi for SCC consisting of periodic in-situ ultrasonic testing or, alternatively, surface examination or bolt replacement, with sample sizes based on EPRI TR-107514 methodology, (7) examination of NSSS support high-strength bolting for SCC concurrent with examinations of the associated supports at least once per 10-year ISI period, and (8) acceptance standards for examination of high-strength structural bolting consistent with the recommendations of EPRI NP--5769 or application specific structural analyses.	A.1.1.8 B.2.8	December 3, 2016

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
6	The Open-Cycle Cooling Water System Program will be enhanced to: (1) include the Nuclear Services and Decay Heat Seawater System Pumps in a periodic inspection and/or rebuild program. This Program will be initiated during the current license period and inspect one or more pumps prior to the period of extended operation, (2) subject the Nuclear Services and Decay Heat Seawater System Discharge Conduits to inspection and evaluation subsequent to the SG replacement project, but prior to the period of extended operation, in order to determine the extent of activities required during the period of extended operation to support the intended function of these components, (3) incorporate hardness/scratch testing for selective leaching into the examinations of susceptible pumps and valves and, if evidence of degradation is detected, of seawater heat exchanger tubesheet cladding, (4) incorporate Nuclear Services and Decay Heat Seawater System Intake Conduit inspections for degraded or missing concrete lining. Affected areas will be monitored to assure no loss of intended function until such time as the lining can be repaired, (5) incorporate acceptance criteria into procedures for inspections for biofouling and maintenance of protective linings, and (6) establish periodic maintenance activities for Nuclear Services and Decay Heat Seawater System expansion joints prior to the period of extended operation.	A.1.1.10 B.2.10	As stated in the Commitment
7	Administrative controls for the Inspection of Overhead Heavy Load and Light Load Handling Systems Program will be enhanced to: (1) include in the Program all cranes within the scope of License Renewal; (2) require the responsible engineer to be notified of unsatisfactory crane inspection results involving loss of material; (3) specify the frequency of inspections for the cranes within the scope of License Renewal to be every refueling outage for cranes in the Reactor Building and every two years for cranes outside the Reactor Building; and, (4) clarify that crane rails are to be inspected for abnormal wear and that members to be inspected for cracking include welds.	A.1.1.12 B.2.12	December 3, 2016
8	The Fire Protection Program administrative controls will be enhanced to: (1) include specific guidance for periodic inspection of fire barrier walls, ceilings, and floors including a requirement to notify Fire Protection of any deficiencies having the potential to adversely affect the fire barrier function; (2) include additional inspection criteria as described in NUREG-1801 for penetration seals; (3) include additional inspection criteria for corrosion of fire doors; (4) specify minimum qualification requirements for personnel performing visual inspections of penetrations seals and fire doors, and (5) specify inspections of fire barrier walls, ceilings, and floors on a frequency of at least once every five years.	A.1.1.13 B.2.13	December 3, 2016

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
9	The Fire Water System Program will be enhanced to: (1) incorporate a requirement to perform one or a combination of the following two activities: (a) Implement periodic flow testing consistent with the intent of NFPA 25, or (b) Perform wall thickness evaluations to verify piping is not impaired by pipe scale, corrosion products, or other foreign maternal. For sprinkler systems, this may be done by flushing, internal inspection by removing one or more sprinkler heads, or by other obstruction investigation methods, (such as technically proven ultrasonic and X-ray examination) that have been evaluated as being capable of detecting obstructions. (These inspections will be performed before the end of the current operating term. The results from the initial inspections will be used to determine inspection intervals thereafter during the period of extended operation.), (2) perform internal inspections of system piping at representative locations as required to verify that loss of material due to corrosion has not impaired system intended function. Alternately, non-intrusive inspections (e.g., ultrasonic testing) can be used to verify piping integrity. (These inspections will be performed before the end of the current operating term. The results from the initial inspections will be used to determine inspection intervals thereafter during the period of extended operation.), (3) incorporate a requirement to perform a visual inspection of yard fire hydrants annually consistent with the intent of NFPA 25 to ensure timely detection of signs of degradation, such as corrosion; and (4) consistent with the intent of NFPA 25, either replace the sprinkler heads prior to reaching their 50-year service life or revise site procedures to perform field service testing, by a recognized testing laboratory, of representative samples from one or more sample areas. (Subsequent testing will be performed on a representative sample at an interval of 10 years after the initial field service testing.)	A.1.1.14 B.2.14	December 3, 2016
10	The Aboveground Steel Tanks Program is a new program to be implemented.	A.1.1.15 B.2.15	December 3, 2016
11	The Fuel Oil Chemistry Program will be enhanced to: (1) adjust the inspection frequency for the Diesel-Driven Emergency Feedwater Pump Fuel Oil Storage Tank to ensure an inspection is performed prior to the period of extended operation; (2) inspect the internal surfaces of the Diesel-Driven Fire Pump Fuel Oil Storage Tanks; and, (3) develop a work activity to periodically inspect the internal surfaces of the Diesel-Driven Fire Pump Fuel Oil Storage Tanks.	A.1.1.16 B.2.16	December 3, 2016
12	The Reactor Vessel Surveillance Program will be enhanced to: (1) ensure that neutron exposure conditions of the reactor vessel remain bounded by those used to project the effects of embrittlement to the end of the 60-year extended license period and (2) establish formalized controls for the storage of archived specimens to ensure availability for future use by maintaining the identity, traceability, and recovery of the archived specimens throughout the storage period.	A.1.1.17 B.2.17	December 3, 2016
13	The One-Time Inspection Program is a new program to be implemented.	A.1.1.18 B.2.18	December 3, 2016
14	The Selective Leaching of Materials Program is a new program to be implemented.	A.1.1.19 B.2.19	December 3, 2016

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
15	The Buried Piping and Tanks Inspection Program is a new program to be implemented.	A.1.1.20 B.2.20	December 3, 2016
16	ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program administrative controls will be revised to incorporate periodic volumetric examinations of ASME Code Class I small-bore socket welds. A volumetric examination technique will be developed capable of detecting cracking in Class 1 socket welds. The total number of socket welds selected for examination will be at least 10% of the total population per interval. Prior to the period of extended operation, CR-3 will perform a baseline inspection equivalent to ⅓ of those inspections required for an interval. The regular inspection schedule is to commence in the 3rd period of the 4th ISI interval.	A.1.1.21 B.2.21	December 3, 2016
17	The External Surfaces Monitoring Program will be enhanced to: (1) incorporate measures to assure the integrity of surfaces that are inaccessible or not readily visible during both plant operations and refueling outages, and (2) incorporate inspection attributes for degradation of coatings.	A.1.1.22 B.2.22	December 3, 2016
18	The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program to be implemented.	A.1.1.23 B.2.23	December 3, 2016
19	Masonry Wall Program administrative controls will be enhanced to (1) identify the structures that have masonry walls in the scope of license renewal, and (2) include inspection of the masonry walls in the Machine Shop in a periodic engineering activity (PMID).	A.1.1.29 B.2.29	December 3, 2016

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
20	The Structures Monitoring Program will be enhanced by revising the administrative controls that implement the Program to: (1) identify all license renewal structures and systems that credit the Program for aging management in the corporate procedure for condition monitoring of structures; (2) require notification of the responsible engineer when below grade concrete including concrete pipe is exposed so an inspection may be performed prior to backfilling; (3) require periodic groundwater chemistry monitoring including consideration for potential seasonal variations; (4) require periodic inspections of the water control structures, i.e., Circulating Water Intake Structure, Circulating Water Discharge Structure, Nuclear Service Sea Water Discharge Structure, Intake Canal, and Raw Water Pits, on a frequency not to exceed five years; (5) require periodic inspections of the Circulating Water Intake Structure submerged portions on a frequency not to exceed five years; (6) identify additional civil/structural commodities and associated inspection attributes and performance standard required for license renewal in the corporate procedure for condition monitoring of structures; (7) identify additional inspection criteria for structural commodities in the site system walkdown checklist; (8) add inspection of corrosion to the inspection criteria for the bar racks at the Circulating Water Intake Structure as a periodic maintenance activity; (9) add an inspection of the earth for loss of form and loss of material for the Wave Embankment Protection Structure as a periodic maintenance activity; (10) include additional in-scope structures and specific civil/structural commodities in periodic engineering activities; (11) require periodic inspections of the Fluorogold slide bearing plates used in structural steel platform applications in the Reactor Building, and (12) require periodic inspection of structures on a frequency of at least once every five years..	A.1.1.30 B.2.30	December 3, 2016
21	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program to be implemented.	A.1.1.31 B.2.31	December 3, 2016
22	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is a new program to be implemented.	A.1.1.32 B.2.32	December 3, 2016
23	The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program to be implemented.	A.1.1.33 B.2.33	December 3, 2016
24	The Metal-Enclosed Bus Program is a new program to be implemented.	A.1.1.34 B.2.34	December 3, 2016
25	The Fuse Holder Program is a new program to be implemented.	A.1.1.35 B.2.35	December 3, 2016
26	The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program to be implemented.	A.1.1.36 B.2.36	December 3, 2016

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
27	Administrative controls for the Fuel Pool Rack Neutron Absorber Monitoring Program will be enhanced to: (1) include provisions to monitor and trend data for incorporation in test procedures to ensure the projection meets the acceptance criteria, (2) incorporate acceptance criteria tables for accumulated weight losses of monitored Carborundum samples, and (3) implement periodic Boron-10 Areal Density Gauge for Evaluating Racks (BADGER) testing or comparable neutron attenuation testing for racks in Pools A and B to ensure that the neutron absorption intended function is maintained, and that technical specification criticality requirements are continually met..	A.1.1.37 B.2.37	December 3, 2016
28	The High-Voltage Insulators in the 230-kV Switchyard Program is a new program to be implemented.	A.1.1.38 B.2.38	December 3, 2016
29	Administrative controls for the Closed-Cycle Cooling Water System Program will be revised to: (1) enhance procedures and activities credited for performance of physical inspections to reflect that inspections of components exposed to closed-cycle cooling water will be performed as made available on an opportunistic basis, (2) flag procedures and activities credited with performance monitoring of parameters in the Instrument Air and Secondary Services Closed-Cycle Cooling Water Systems to assure pump and heat exchanger performance are identified as license renewal activities, and (3) flag procedures associated with closed-cycle cooling water chemistry controls to identify chemistry controls associated for in-scope systems as license renewal activities.	A.1.1.11 B.2.11	December 3, 2016
30	Implementing procedures for the Steam Generator Tube Integrity Program will be enhanced to ensure compliance with the requirements in NUREG-1801, Revision 1, Section XI.M19	A.1.1.9 B.2.9	December 3, 2016

APPENDIX B

CHRONOLOGY

This appendix lists chronologically the licensing correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff) and Florida Power Corporation (doing business as Progress Energy Florida Inc. (Progress or the applicant)). This appendix also lists other correspondence concerning the staff's review of the Crystal River Unit 3 Nuclear Generating Plant license renewal application (LRA) (Docket Nos. 50-302).

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Date	**Subject**
12/16/2008	Letter from Young D E, Progress Energy Florida, Inc., to NRC, Crystal River Unit 3 - Transmittal of Application for Renewal of Operating License (ADAMS Accession No. ML090080054)
12/16/2008	Letter from Young D E, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3, Systems Drawings Supporting License Renewal (ADAMS Accession No. ML090050253)
1/29/2009	Letter from Holian B E, NRC, to Young D E, Progress Energy Florida, Inc, Receipt and Availability of the License Renewal Application for the Crystal River Unit 3, Nuclear Generating Plant (ADAMS Accession No. ML083470614)
1/29/2009	Federal Register Notice, Notice of Receipt and Availability of Application for Renewal of Crystal River Unit 3, Nuclear Generating Plant (ADAMS Accession No. ML083510653)
1/29/2009	Federal Register Notice Receipt and Availability of the License Renewal Application for the Crystal River Unit 3 Nuclear Generating Plant (FRN) (ADAMS Accession No. ML090290253)
2/27/2009	Letter from Holian B E, NRC, to Young D E, Florida Power Corp., Determination of Acceptability and Sufficiency for Docketing, and Opportunity for a Hearing Regarding the Application from Florida Power Corp., for Renewal of the Operating License for Crystal River Unit 3 Nuclear Generating Plant (ADAMS Accession No. ML090090233)
2/27/2009	Federal Register Notice, Notice of Opportunity For Hearing Regarding Renewal of Facility Operating License No. DPR-72 for an Additional 20-year Period Florida Power Corporation Corporation Crystal River Unit 3 Nuclear Generating Plant Docket No. 50-302 (ADAMS Accession No. ML090210171)

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Date	**Subject**
3/31/2009	Federal Register Notice, Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0278) (ADAMS Accession No. ML090780840)
3/31/2009	Letter from Wrona D J, NRC, to Young D E, Florida Power Corp., Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0278) (ADAMS Accession No. ML090350657)
4/20/2009	Letter from Kuntz R F, NRC, to Young D E, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML090850176)
5/11/2009	Letter from Franke J A, Progress Energy Corp., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for the Review of the License Renewal Application (ADAMS Accession No. ML091380023)
5/22/2009	Letter from Wrona D J, NRC, to Young D E, Florida Power Corp., Proposed Review Schedule Regarding the Application from Florida Power Corporation for Renewal of the Operating License for Crystal River Unit 3 Nuclear Generating Plant (ADAMS Accession No. ML091200415)
5/29/2009	Letter from Franke J A, Progress Energy Florida, Inc., NRC, Crystal River, Unit 3, NRC Correspondence Distribution List Update (ADAMS Accession No. ML091530029)
7/8/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Plan for the Aging Management Program Regulatory Audit Regarding the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application Review (ADAMS Accession No. ML091820465)
7/30/2009	Letter from Kuntz R F, NRC, to Young D E, Progress Energy Florida, Inc., Audit Report Regarding the LRA for the Crystal River, Unit 3 (ADAMS Accession No. ML091660559)
8/3/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML091740070)

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Date	**Subject**
8/14/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp, Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML092030208)
8/14/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML092080045)
8/20/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Crystal River Unit 3, RAI, License Renewal Application (ADAMS Accession No. ML092020012)
8/20/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML092250701)
8/31/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., RAI for the Review of the Crystal River Unit 3 Nuclear Generating Plant, LRA (ADAMS Accession No. ML092330007)
8/31/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Crystal River Unit 3 Nuclear Generating Plant, RAI, License Renewal Application (ADAMS Accession No. ML092330343)
8/31/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Crystal River, Unit 3, Request for Additional Information Regarding License Renewal Application (ADAMS Accession No. ML092330831)
9/2/2009	Letter from Kuntz R F, NRC to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML092330904)
9/11/2009	Letter from Franke J A, Progress Energy Corp., to NRC, Crystal River Unit 3 - Response to Requests for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) and Amendment #2 (ADAMS Accession No. ML092580095)

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Date	**Subject**
9/11/2009	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for the Review of the License Renewal Application (ADAMS Accession No. ML092600888)
9/11/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML092160213)
9/18/2009	Letter from Franke J A, Progress Energy Corp., to NRC, Crystal River, Unit 3 - Response to Requests for Additional Information for the Review of the License Renewal Application and Amendment #3 (ADAMS Accession No. ML092650272)
9/22/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Unit Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML092370669)
9/29/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Scoping and Screening Audit Report Regarding the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML092610309)
9/30/2009	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River Unit 3 - Response to Requests for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) and Amendment #4 (ADAMS Accession No. ML092790150)
10/2/2009	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River Unit 3 - Response to Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (TAC No. ME0274) - Sections B.2.37-1, 3.3.2.2, and XI.S8 (ADAMS Accession No. ML092790154)
10/13/2009	Letter from Franke J A, Florida Power Corp., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for the Review of Unit 3 Nuclear Generating Plant License Renewal Application and Amendment #5 (ADAMS Accession No. ML092890155)
10/15/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3

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Date	**Subject**
	Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML092640554)
10/22/2009	Letter from Franke J A, Florida Power Corp., to NRC, Crystal River, Unit 3, Response to Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (TAC No. ME0274) - and Amendment #6 (ADAMS Accession No. ML093000505)
10/27/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC ME0274) (ADAMS Accession No. ML092960660)
11/3/2009	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River, Unit 3 Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML092940322)
11/12/2009	Letter from Franke J A, Progress Energy Florida, Inc., NRC, Crystal River, Unit 3 - Response to Request for Additional Information for Review of License Renewal Application, Section 2.3 (ADAMS Accession No. ML093210167)
11/30/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML093230559)
12/1/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Review Application (ADAMS Accession No. ML093030147)
12/3/2009	Meeting Summary from Kuntz R F, NRC, to Florida Power Corp., 10/28/09 Summary of Telephone Conference Call Held Between NRC and Florida Power Corp., Concerning License Response to a Request for Additional Information Related Pertaining to Crystal River ,Unit 3 License Renewal Application (ADAMS Accession No. ML093290034)
12/3/2009	Letter from Franke J A, Progress Energy Carolinas, Inc., to NRC, Crystal River Nuclear Generating Plant, Unit 3, Response to Request for Additional Information for the Review of the License Renewal Application (TAC No.

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Date	**Subject**
	ME0274) (ADAMS Accession No. ML093410638)
12/10/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., AREVA NP, Inc.- Request for Withholding Information from Public Disclosure for Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0274) (ADAMS Accession No. ML093310295)
12/10/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., AREVA NP, Inc. - Request for Withholding Information from Public Disclosure for Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0274) (ADAMS Accession No. ML093270496)
12/14/2009	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., AMP Audit Report Regarding the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML093200023)
12/14/2009	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3, License Renewal Application 10 CFR Part 54.21(b) Annual Update (ADAMS Accession No. ML093520079)
12/30/2009	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River Unit 3, Response to Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) and Amendment #8 (ADAMS Accession No. ML100040096)
1/4/2010	Meeting Summary from Kuntz R F, NRC, Summary of Telephone Conference Call on 10/29/09, Between the USNRC and Florida Power Corporation, Concerning Licensee Response to a Request for Information Related to the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML093451395)
1/25/2010	Letter from Wrona D J, NRC, to Franke J A, Florida Power Corp., Revised Review Schedule Regarding the Application from Florida Power Corporation for Renewal of the Operating License for Crystal River Unit 3 Nuclear Generating Plant (ADAMS Accession No. ML100050166)
1/27/2010	Letter from Franke J A, Progress Energy Corp., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for the Review of the License Renewal Application & Amendment 9 (ADAMS Accession No. ML100290366)

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Date	**Subject**
2/2/2010	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (ADAMS Accession No. ML100100010)
2/2/2010	Meeting Summary from Kuntz R F, NRC, to Florida Power Corp., 12/10/2009 Summary of Telephone Conference Call Held Between the U.S. Nuclear Regulatory Commission and Florida Power Corporation, Concerning the Applicant's Response to a Request for Additional Information Pertaining to the Crystal River, Unit 3 (ADAMS Accession No. ML100070317)
2/16/2010	Letter from Kuntz R F, NRC, to Florida Power Corp., Summary of Telephone Conference Call Held on 12/1/09, Between the U.S. NRC and Florida Power Corp., Concerning Licensee Response to a RAI Pertaining to the Crystal River Unit 3 Nuclear Generating Plant License Renewal Application (ADAMS Accession No. ML100141593)
2/19/2010	Meeting Summary from Kuntz R F, NRC, to Florida Power Corp., Summary of Telephone Conference call Held on December 23, 2009, Between the U.S. NRC and Florida Power Corporation, Concerning Applicant's Response to a RAI Pertaining to the Crystal River Unit 3 Nuclear Generating Plant License Renewal (ADAMS Accession No. ML100320036)
3/1/2010	Meeting Summary from Kuntz R F, NRC, to Florida Power Corp., Summary of Telephone Conference Call Held on November 11, 2009, Between the U.S. NRC and Florida Power Corporation, Concerning a Draft RAI and the Applicant's Response to a RAI Pertaining to the Crystal River Unit 3 Nuclear Generating Plant LRA (ADAMS Accession No. ML100090050)
3/3/2010	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3, Response to Request for Additional Information for Review of License Renewal Application and Amendment #10 (ADAMS Accession No. ML100640667)
4/1/2010	Letter from Franke J A, Florida Power Corp., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for Review of License Renewal Application - Environmental Review (ADAMS Accession No. ML100970076)
5/21/2010	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS

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Date	**Subject**
	Accession No. ML101130223)
6/2/2010	Letter from Kuntz R F, NRC, to Franke J A, Florida Power Corp., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML101410512)
6/21/2010	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River Unit 3 - Response to Requests for Additional Information for the Review of License Renewal Application (TAC No. ME0274) and Amendment #11 (ADAMS Accession No. ML101740057)
7/8/2010	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML101740497)
7/8/2010	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., RAI for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML101530397)
8/9/2010	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3 - Response to Requests for Additional Information for the Review of the License Renewal Application and Amendment #12 (ADAMS Accession No. ML102230030)
8/12/2010	Letter from Wrona D J, NRC, to Franke J A, Progress Energy Florida, Inc., Revised Review Schedule Regarding the Application from Florida Power Corporation for Renewal of the Operating License for Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0278) (ADAMS Accession No. ML101460577)
10/14/2010	Letter from Kuntz R F, NRC, to Franke J A, Progress Energy Florida, Inc., Request for Additional Information for the Review of the Crystal River Unit 3 Nuclear Generating Plant, License Renewal Application (TAC No. ME0274) (ADAMS Accession No. ML102600243)
10/19/2010	Meeting Summary from Kuntz R F, NRC, 09/27/10 Summary of Telephone Conference Call Held Between NRC and Florida Power Corp., Concerning Draft Request for Information Related to Crystal River, Unit 3, License

APPENDIX B: CHRONOLOGY	
Date	**Subject**
	Renewal Application (ADAMS Accession No. ML102710065)
11/5/2010	Letter from Wrona D J, NRC, to Franke J A, Florida Power Corp., Revised Review Schedule Regarding the Application from Florida Power Corporation for Renewal of the Operating License for Crystal River Unit 3 Nuclear Generating Plant (TAC No. ME0278) (ADAMS Accession No. ML103070380)
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11/12/2010	Letter from Franke J A, Florida Power Corp., to NRC, Crystal River, Unit 3 - Response to Request for Additional Information for the Review of the License Renewal Application and Amendment #13 (ADAMS Accession No. ML103200064)
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11/23/2010	Letter from Franke J A, Progress Energy Florida, Inc., to NRC, Crystal River, Unit 3, Response to Request for Additional Information for the Review of License Renewal (ADAMS Accession No. ML103280373)

APPENDIX C

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This appendix lists the principal contributors for the development of this safety evaluation report (SER) and their areas of responsibility.

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APPENDIX D

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This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for Crystal River Nuclear Generating Plant, Unit 3.

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