Safety Evaluation Report

Related to the License Renewal of LaSalle County Station, Units 1 and 2

Docket Nos. 50-373 and 50-374

Exelon Generation Company, LLC

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

June 2016

ABSTRACT

This safety evaluation report (SER) documents the technical review of the LaSalle County Station, Units 1 and 2 (LSCS), license renewal application (LRA) by the United States (U.S.) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated December 9, 2014, Exelon Generation Company, LLC (Exelon or the applicant), submitted the LRA in accordance with Title 10 of the *Code of Federal Regulations,* (10 CFR) Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” Exelon requests renewal of the LSCS operating licenses (Operating License Nos. NPF-11 and NPF-18) for a period of 20 years beyond the current expiration at midnight on April 17, 2022, for Unit 1, and at midnight on December 16, 2023, for Unit 2.

LSCS is located approximately 55 direct-line miles southwest of Chicago, IL. The NRC issued the Unit 1 and Unit 2 construction permits (CPPR-99 and CPPR-100, respectively) on September 7, 1973, and the operating licenses on April 17, 1982, for Unit 1, and December 16, 1983, for Unit 2. Units 1 and 2 are of a boiling water reactor design. General Electric (Nuclear Energy Division) supplied the nuclear steam supply system and Sargent & Lundy originally designed and constructed the balance of the plant. Units 1 and 2 each have a licensed power output of 3,546 megawatts thermal, with a gross electrical output of approximately 1,207 megawatts electric.

Unless otherwise indicated, this SER presents the status of the staff’s review of information submitted through April 30, 2016, the cutoff date for consideration in the SER. The two open items previously identified in the SER with open items, issued February 29, 2016, have been closed (see Section 1.5); therefore, no open items remain to be resolved before the final determination is reached by the staff on the LRA.

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ABBREVIATIONS

°F	degree(s) Fahrenheit
1/4T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel
AAI	applicant action item
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor steel reinforced
ADAMS	Agencywide Document Access and Management System
ADS	automatic depressurization system
AEM	aging effect/mechanism
AERM	aging effect requiring management
AFW	auxiliary feedwater
AMP	aging management program
AMR	aging management review
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
BTP	Branch Technical Position
BWR	boiling water reactor
BWROG	Boiling Water Reactor Owners Group
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CAR	condenser and air removal
CAS	Compressed Air System
CASS	cast austenitic stainless steel
CB&I	Chicago Bridge and Iron Company
CCW	Closed Cycle Cooling Water
CE	Combustion Engineering
CECo	Commonwealth Edison Company
CEOG	Combustion Engineering Owners Group
CFR	*Code of Federal Regulations*
CGC	combustible gas control
CHRE	Cranes, Hoists and Refueling Equipment
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified material test report
CO_2	carbon dioxide
CRD	control rod drive
CRDRL	control rod drive return line
CRV	control room ventilation
CSCS	core standby cooling system
CUF	cumulative usage factor
CUF_{en}	environmentally adjusted cumulative usage factor
DBA	design basis accident

DBE	design basis event
DGA	diesel generator and auxiliaries
DPS	Drywell Pneumatic System
EAF	environmentally assisted fatigue
ECCS	Emergency Core Cooling System
EDG	emergency diesel generator
EFPY	effective full-power year
EPP	electrical penetration pressurization
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	environmental report (Applicant's Environmental Report Operating License Renewal Stage)
ESF	engineered safety features
Exelon	Exelon Generation Company, LLC
FASA	focused area self-assessment
F_{en}	environmental fatigue life correction factor
FERC	Federal Energy Regulatory Commission
FPR	fire protection report
FR	*Federal Register*
FSAR	final safety analysis report
ft	foot (feet)
ft-lb	foot-pound
GALL	Generic Aging Lessons Learned
GE	General Electric Company
GEH	General Electric Hitachi
GEIS	Generic Environmental Impact Statement
GL	generic letter
GSI	generic safety issue
HAZ	heat affected zone
HELB	high-energy line break
HPCS	high pressure core spray
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and controls
IASCC	irradiation-assisted stress corrosion cracking
ID	inside diameter
IE	inspection and enforcement
I&FE	inspection and flaw evaluation
IGSCC	intergranular stress corrosion cracking
IN	information notice
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
ISP	integrated surveillance program

ksi	kilopound(s) per square inch
kV	kilovolt(s)
lb	pound(s)
LBB	leak before break
LCO	limiting condition(s) of operation
LOCA	loss-of-coolant accident
LPCI	low-pressure coolant injection
LPCS	low pressure core spray
LPRM	local power range monitor
LRA	license renewal application
LR-ISG	license renewal interim staff guidance
LSCS	LaSalle County Station, Units 1 and 2
LTOP	low-temperature overpressure protection
μm	micrometer
MEB	metal-enclosed bus
MeV	million electron volt(s)
MIC	microbiologically-influenced corrosion
MoS_2	molybdenum disulfide
MPa	megapascal
mpy	mil per year
MRV	minimum required valve
MSRV	main steam relief valve
MS	main steam
MSIV	main steam isolation valve
MTA	main turbine and auxiliaries
mV	millivolt(s)
n/cm^2	neutrons per square centimeter
NEDO	New Energy and Industrial Technology Development Organization
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
OBE	operating-basis earthquake
OI	Open Item
OPEX	Exelon Operating Experience (Program)
PCV	primary containment ventilation
pH	potential of hydrogen
PLL	predicted lower limit
PSP	process sampling and post-accident monitoring
psi	pound(s) per square inch
psig	pound(s) per square inch, gauge
P-T	pressure-temperature
PTLR	pressure-temperature limit report
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking

QA	quality assurance
radwaste	radioactive waste
RAI	request for additional information
RAMA	Radiation Analysis Modeling Application
RBCCW	reactor building closed cooling water
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	Reactor Coolant System
RCSC	Research Council on Structural Connections
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RI-ISI	Risk-Informed Inservice Inspection
RPV	reactor pressure vessel
RT_{NDT}	reference temperature nil ductility transition
RVI	reactor vessel internals
RWCU	reactor water cleanup
SAT	system auxiliary transformer
SBA	small break accident
SBO	station blackout
SC	structure and component
SCC	stress corrosion cracking
SE	safety evaluation
SER	safety evaluation report
SGT	Standby Gas Treatment
SLC	standby liquid control
SMAW	shielded metal-arc welding
S-N	stress versus number of cycles
SPC	Suppression Pool Cleanup
SRP	Standard Review Plan
SRM	source range monitor
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SRV	safety-related ventilation
SSC	system, structure, and component
SSE	safe-shutdown earthquake
TBCCW	turbine building closed cooling water
TIP	traversing incore probe
TLAA	time-limited aging analysis
TS	Technical Specification(s)
UFSAR	updated final safety analysis report
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet
VAC	volt(s) alternating current

VDC	volt(s) direct current
VFLD	vessel flange leak detection
WPC	wear particle count
yr	year
Zn	zinc

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for LaSalle County Station, Units 1 and 2 (LSCS), as filed by Exelon Generation Company, LLC (Exelon or the applicant). By letter dated December 9, 2014, Exelon submitted its application to the United States (U.S.) Nuclear Regulatory Commission (NRC) for renewal of the LSCS operating licenses 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 of the *Code of Federal Regulations* (CFR) Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.” The NRC project manager for the license renewal review is Mr. Jeffrey Mitchell. Mr. Mitchell may be contacted by telephone at 301-415-3019 or by electronic mail at jeffrey.mitchell2@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Jeffrey Mitchell, Mail Stop O11-F1

In its December 9, 2014, submission letter, the applicant requested renewal of the operating licenses issued under Section 103 (Operating License Nos. NPF-11 and NPF-18) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), for Units 1 and 2, respectively, for a period of 20 years beyond the current expiration at midnight on April 17, 2022, for Unit 1 and at midnight on December 16, 2023, for Unit 2. LSCS is located approximately 55 direct-line miles southwest of Chicago, Illinois. The NRC issued the construction permits for Units 1 and 2 on September 10, 1973. The NRC issued the operating licenses for Unit 1 and Unit 2 on April 17, 1982, and December 16, 1983, respectively. Units 1 and 2 are of a boiling water reactor (BWR) design. General Electric (Nuclear Energy Division) supplied the nuclear steam supply system, and Sargent & Lundy originally designed and constructed the balance of the plant. Units 1 and 2 each have a licensed power output of 3,546 megawatts thermal, with a gross electrical output of approximately 1,207 megawatts electric each. The updated final safety analysis report (UFSAR) shows details of the plant and the site.

The license renewal process consists of two concurrent technical reviews: a review of safety issues, and an environmental review. The NRC regulations at 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” 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 LSCS license renewal is based on the applicant’s LRA and 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 February 1, 2016. The staff reviewed information received after this 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, including the UFSAR, 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 at the Reddick Public Library District, 1010 Canal St., Ottawa, IL 61350; Marseilles Public Library, 155 East Bluff St., Marseilles, IL 61341; and Seneca Public Library District, 210 N. Main St., Seneca, IL 61360. 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 LSCS's proposed operation for an additional 20 years beyond the term of the current operating licenses. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010.

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 licenses. 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 prepared a draft plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." This supplement discusses the environmental considerations for license renewal for LSCS. The staff issued draft, plant-specific GEIS Supplement 57, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 57, Regarding LaSalle County Station, Units 1 and 2, Draft Report for Comment," in February 2016.

1.2 License Renewal Background

In accordance with 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 of the *Federal Register*, page 64943 (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 to fulfill NRC responsibilities under the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.). In June 2013, the staff revised and updated the environmental protection regulations (10 CFR Part 51) and issued a revised GEIS (GEIS, Revision 1) to incorporate lessons learned and knowledge gained from previous plant-specific environmental reviews. The revisions identify 78 environmental impact issues for consideration in license renewal environmental reviews, 59 of which have been determined to be generic to all plant sites.

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, pressurized thermal shock, anticipated transient without scram, and station blackout.

In accordance with 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. In accordance with 10 CFR 54.21(a), a license renewal applicant must demonstrate that the aging effects will be managed so 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.

In accordance with 10 CFR 54.21(d), the LRA is required to include a UFSAR supplement that contains a summary description of the applicant's programs and activities for managing the effects of aging 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 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses." This regulatory guide 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 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 used the process defined in NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010. 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 environmental protection regulations. 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. In accordance with 10 CFR 51.53(c)(3)(i), a license renewal applicant may incorporate these generic findings in its environmental report (ER). In accordance with 10 CFR 51.53(c)(3)(ii), an ER also must include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In June 2013, the NRC staff issued a final rule revising 10 CFR Part 51 to update the potential environmental impacts associated with the renewal of an operating license for a nuclear power reactor for an additional 20 years. Revision 1 to the GEIS was issued concurrently with the final rule. The revised GEIS specifically supports the revised list of environmental issues identified in the final rule. Revision 1 to the GEIS and the 2013 final rule reflect lessons learned and knowledge gained during previous license renewal environmental reviews.

In accordance with the National Environmental Policy Act of 1969, as amended, 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 March 10, 2015, at the LaSalle County Emergency Management Agency in Ottawa, Illinois, to identify plant-specific environmental issues. The draft, plant-specific GEIS Supplement 57 documents the results of the environmental review and makes a preliminary recommendation as to the license renewal action. The staff held another public meeting on March 22, 2016, at the LaSalle County Emergency Operations Center in Ottawa, Illinois, to discuss the draft, plant-specific GEIS Supplement 57. After considering comments on the draft, the staff will publish the final, plant-specific GEIS Supplement 57 separately from this report.

1.3 Principal Review Matters

Part 54 of 10 CFR describes the requirements for 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.

In accordance with 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.

In accordance with 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 – Form of Indemnity Agreement with Licensees Furnishing Insurance Policies As Proof of Financial Protection," to account for the expiration term of the proposed renewed license." On this issue, the applicant stated in the LRA:

> 10 CFR Part 54.19(b) requires that "each application must include conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement (No. B-84) for LaSalle County Station, Units 1 and 2, 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, which is the last to expire; provided that, except as may otherwise be provided in applicable regulations or orders of the Commission, the term of this agreement shall not terminate until all the radioactive material has been removed from the location and transportation of the radioactive material from the location has ended as defined in subparagraph 5(b), Article I.*" Item 3 of the Attachment to the indemnity agreement includes license numbers NPF-11 and NPF-18. Applicant requests that any necessary conforming changes be made to Article VII and Item 3 of the Attachment, and any other sections of the indemnity agreement as

> appropriate to ensure that the indemnity agreement continues to apply during both the terms of the current licenses and the terms of the renewed licenses. Applicant understands that no changes may be necessary for this purpose if the current license numbers are retained.

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

In accordance with 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) a UFSAR 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).

In accordance with 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 UFSAR supplement. By letter dated December 2, 2015, the applicant submitted an LRA update that summarizes the CLB changes that have occurred during the staff’s review of the LRA. This submission has been reviewed by the staff and satisfies 10 CFR 54.21(b) requirements.

In accordance with 10 CFR 54.22, “Contents of Application – Technical Specifications,” the NRC requires that the LRA include changes or additions to the technical specifications that are necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that it had not identified any changes to the technical specifications that would be necessary for issuance of the renewed LSCS operating licenses. 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, “Standards for Issuance of a Renewed License.”

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 it is incorporated into license renewal guidance documents, such 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
"Aging Management of Stainless Steel Structures and Components in Treated Borated Water," Revision 1 (LR-ISG-2011-01)	This LR-ISG clarifies the staff's existing position on aging management in treated borated water environments.	Not Applicable to BWRs
"Aging Management Program for Steam Generators" (LR-ISG-2011-02)	This LR-ISG evaluates the suitability of using Revision 3 of NEI 97-06 for implementing the licensee's steam generator AMP.	Not Applicable to BWRs
"Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, 'Buried and Underground Piping and Tanks'" (LR-ISG-2011-03)	This LR-ISG gives additional guidance on managing the effects of aging on buried and underground piping and tanks.	SER Sections 3.0.3.1.12, 3.0.3.2.14, and 3.3.2.1.9
"Updated Aging Management Criteria for Reactor Vessel Internal Components of Pressurized Water Reactors" (LR-ISG-2011-04)	This LR-ISG updates the GALL Report, Revision 2, and SRP-LR, Revision 2, to ensure consistency with MRP-227-A for the aging management of age-related degradation for components of pressurized water reactor vessel internals during the term of a renewed operating license.	Not Applicable to BWRs
"Ongoing Review of Operating Experience" (LR-ISG-2011-05)	This LR-ISG clarifies the staff's existing position in the SRP-LR that acceptable license renewal AMPs should be informed and enhanced, when necessary, based on the ongoing review of both plant-specific and industry operating experience.	SER Section 3.0.5
"Wall Thinning Due to Erosion Mechanisms" (LR-ISG-2012-01)	This LR-ISG gives additional guidance on managing the effects of wall thinning due to erosion mechanisms.	SER Section 3.0.3.1.7
"Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation" (LR-ISG-2012-02)	This LR-ISG gives guidance on managing the effects of aging for internal surfaces, fire water system, atmospheric storage tanks, and corrosion under insulation.	SER Sections 3.0.3.1.12, 3.0.3.1.13, 3.0.3.2.5, 3.0.3.2.6, 3.0.3.2.10, 3.0.3.2.11, 3.2.2.2.9, and 3.4.2.2.6
"Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" (LR-ISG-2013-01)	This final LR-ISG gives guidance on aging management for coating or lining integrity for internal coatings/linings on in-scope piping, piping components, heat exchangers, and tanks.	SER Sections 3.0.3.3.1, 3.2.2.1.1, 3.2.2.3.3, 3.3.2.1.1, 3.3.2.3.7, and 3.4.2.1.1
"Changes to Buried and Underground Piping and Tank Recommendations" (LR-ISG-2015-01)	This LR-ISG replaces AMP XI.M41, "Buried and Underground Piping and Tanks," and the associated FSAR Summary Description. The LR-ISG provides revised guidance on managing aging effects associated with buried and underground piping and tanks.	SER Section 3.0.3.2.14

1.5 Summary – Closure of Open Items

As a result of its review of the LRA, including additional information submitted through April 30, 2016, the staff closed the following open items previously identified in the "Safety Evaluation Report with Open Items Related to the License Renewal of LaSalle County Station, Units 1 and 2," dated February 29, 2016 (ADAMS Accession No. ML16053A439). No other open items remain to be addressed. 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. A summary of the basis for each closed open item is presented here.

Open Item 3.0.3.1.2-1: BWR Vessel ID Attachment Welds

The LRA describes the BWR Vessel ID Attachment Welds program as an existing program that is consistent with the program elements in GALL Report AMP XI.M4, "BWR Vessel ID Attachment Welds." During the AMP audit, the staff reviewed documents relevant to the program, including ER-AB-331, Revision 14, and verified that program elements 1 through 6 are consistent with the corresponding program elements of GALL Report AMP XI.M4. However, as a result of the subsequent NRC Regional Inspector's IP-71002 License Renewal Inspection at LSCS, the staff had an opportunity to review the applicant's document ER-AB-331 again and noted that changes to the examination qualification requirements in Boiling Water Reactor Vessel and Internals Project (BWRVIP)-03, "Reactor Pressure Vessel and Internals Examination Requirements," regarding enhanced visual examinations (EVT-1s) may have reduced the effective examination coverage to zero percent in some cases. Based on the AMP Audit Report dated September 22, 2015, the staff notes that the ER-AB-331 is the main implementing document for the applicant's BWR Vessel ID Attachment Welds and BWR Vessel Internals AMPs. By letter dated February 16, 2016, the staff issued RAI B.2.1.4-1, requesting that the applicant provide clarification regarding the EVT-1 inspections performed at LSCS.

In its response dated February 25, 2016, the applicant provided a summary of the attachment welds examined by the BWR Vessel ID Attachment Welds program and the percent coverage of these examinations. In addition, the applicant stated that zero-percent examinations are unlikely, and it revised its procedures to enter this condition into the LSCS corrective action program if it were to happen. The staff's evaluation of the response to RAI B.2.1.4-1 and the bases for closure of OI 3.0.3.1.2-1 are documented in SER Section 3.0.3.1.2.

Open Item 3.0.3.1.5-1: BWR Stress Corrosion Cracking

Based on information from the license renewal inspections at LSCS, it was unclear to the staff what examination coverage percentage the applicant considered as necessary for a weld to be credited as inspected in the BWR Stress Corrosion Cracking program. By letter dated February 16, 2016, the staff issued RAI B.2.1.7-3b to determine the percentage of examination coverage that the applicant considers for crediting a weld inspection in this program and to provide the technical bases for crediting examinations when the coverage obtained is less than 90 percent.

In its response dated February 25, 2016, the applicant stated that the procedure for inservice inspections of welds will be revised to clarify the extent of evaluation for weld examinations that are only credited under this program, when greater than 90 percent coverage is not achieved. An engineering technical evaluation will be required with a content comparable to a relief request, and such welds may be considered "inspected" if they have been examined to the maximum coverage attainable using the PDI (performance demonstration initiative) methods.

The staff’s evaluation of the response to RAI B.2.1.7-3b and the bases for closure of OI 3.0.3.1.5-1 are documented in SER Section 3.0.3.1.5.

1.6 Summary of Confirmatory Items

As a result of its review of the LRA, including additional information submitted through April 30, 2016, the staff determines that no confirmatory items that would require a formal response from the applicant exist.

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 two proposed license conditions.

(1) The information in the UFSAR supplement, submitted pursuant to 10 CFR 54.21(d), as revised during the license renewal application review process, and licensee commitments as listed in Appendix A of the “Safety Evaluation Report Related to the License Renewal of LaSalle County Station, Unit 1 and 2, are collectively the “License Renewal UFSAR Supplement.” This Supplement is henceforth part of the UFSAR, which will be updated in accordance with 10 CFR 50.71(e). As such, the licensee may make changes to the programs, activities, and commitments described in this Supplement, provided the licensee evaluates such changes pursuant to the criteria set forth in 10 CFR 50.59, “Changes, Tests and Experiments,” and otherwise complies with the requirements in that section.

(2) The License Renewal UFSAR Supplement, as updated by license condition [1] above, describes certain programs to be implemented and activities to be completed prior to the period of extended operation (PEO).

   a. The applicant shall implement those new programs and enhancements to existing programs no later than 6 months prior to the PEO.

   b. The applicant shall complete those activities by the 6-month date prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

   c. The applicant shall notify the NRC in writing within 30 days after having accomplished item (a) above and include the status of those activities that have been or remain to be completed in item (b) above.

The purpose of requiring the completion of implementation, inspection, and testing either before the end of the last refueling outage or before the 6-month timeframe is to ensure that the implementation of programs and completion of specific activities can be confirmed by the staff’s oversight process before each plant enters its respective period of extended operation.

LRA Appendix A, Section A.5, “License Renewal Commitment List,” contains commitments for license renewal and an associated schedule for when the applicant plans to implement or complete the commitments. Through the commitments in LRA Appendix A, Section A.5, the applicant will implement new programs, will implement enhancements to existing programs, and will also complete inspection or testing activities.

Because the applicant’s implementation schedule for some commitments, as provided originally in LRA Appendix A, Section A.5, could conflict with the implementation schedule intended by the generic second license condition described above, by letter dated December 14, 2015, the staff issued RAI A.5-1, which requested that the applicant provide the expected date for implementing each commitment before the period of extended operation and state whether the implementation would be documented as a license condition or as a supplement to the UFSAR. By letter dated January 7, 2016, the applicant responded to RAI A.5-1 and provided a revision to LRA Appendix A, Sections A.1.0.1 and A.5, in which it specified the time period when each commitment would be implemented and where it would be documented. Specifically, the applicant stated:

- Implementation of new aging management programs and enhancements to existing aging management programs will be completed no later than six months prior to the respective period of extended operation (PEO) for each LaSalle County Station unit; and
- Inspection or testing activities identified for completion prior to the PEO will be completed either:
  - no later than six months prior to the respective PEO for each LaSalle County Station unit, or
  - prior to the end of the last refueling outage before the respective PEO for each unit, whichever occurs later.

The applicant also stated that, upon receipt of the renewed license, Appendix A of the LRA will be part of the LSCS UFSAR, which will be updated in accordance with 10 CFR 50.71(e).

The staff finds the applicant’s response to RAI A.5-1 acceptable because (1) the staff reviewed the applicant’s response and revision of LRA Appendix A and confirmed that the applicant identified those commitments that implement new programs and enhancements to existing programs and stated that these commitments will be implemented no later than 6 months before the period of extended operation, which is consistent with the second proposed license condition, (2) the staff also confirmed that, as part of its response, the applicant identified the commitments that complete inspection or testing activities and stated, consistent with the second proposed license condition, that these commitments will be implemented 6 months before the period of extended operation or by the end of the last refueling outage before the period of extended operation, whichever occurs later, and (3) all commitments in LRA Appendix A will be incorporated into the LSCS UFSAR. The staff’s concerns described in RAI A.5-1 are resolved.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Title 10 of the *Code of Federal Regulations* (CFR), Section 54.21, "Contents of Application – Technical Information," requires the applicant to identify the systems, structures and components (SSCs) within the scope of license renewal in accordance with 10 CFR 54.4(a). In addition, the license renewal application (LRA) must contain an integrated plant assessment (IPA). The IPA identifies and lists those structures and components (SCs), which are contained in the SSCs that are identified to be within the scope of license renewal, that are subject to an aging management review (AMR).

2.1.2 Summary of Technical Information in the Application

LRA Section 2.0, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results," provides the technical information required by 10 CFR 54.21(a). LRA Section 2.0 states, in part, that the applicant had considered the following in developing the scoping and screening methodology described in LRA Section 2.0:

- 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (the Rule)
- 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 (NEI 95-10)

LRA Section 2.1, "Scoping and Screening Methodology," describes the methodology used by Exelon Generation Company, LLC (Exelon or the applicant), to identify the SSCs at LaSalle County Station, Units 1 and 2 (LSCS), within the scope of license renewal (scoping) and the SCs subject to an AMR (screening).

2.1.3 Scoping and Screening Program Review

The staff evaluated the applicant's scoping and screening methodology in accordance with the guidance in Section 2.1, "Scoping and Screening Methodology," of NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010. The following regulations provide the basis for the acceptance criteria used by the staff to assess the adequacy of the scoping and screening methodology used by the applicant to develop the LRA:

- 10 CFR 54.4(a), as it relates to the identification of SSCs within the scope of the Rule
- 10 CFR 54.4(b), as it relates to the identification of the intended functions of SSCs within the scope of the Rule

- 10 CFR 54.21(a), as it relates to the methods used by the applicant to identify SCs subject to an AMR

The staff reviewed the information in LRA Section 2.1 to confirm that the applicant described a process for identifying SSCs that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a) and SCs that are subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)

In addition, the staff conducted a scoping and screening methodology audit at the LSCS facility located in LaSalle County, Illinois, during the week of March 9–13, 2015. 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 methodology described in the LRA and the requirements of the Rule. The staff reviewed the project-level guidelines, technical basis documents, and implementing procedures that describe the applicant's scoping and screening methodology. The staff conducted detailed discussions with the applicant on the implementation and control of the license renewal methodology, the quality practices used by the applicant during the LRA development, and the training of the applicant's staff that participated in the LRA development.

On a sampling basis, the staff performed a review of scoping and screening results reports and supporting current licensing basis (CLB) information for portions of the essential cooling water (ECW) system and corresponding structures. In addition, the staff performed walkdowns of selected portions of those systems and structures as a part of the sampling review of the implementation of the applicant's 10 CFR 54.4(a)(2) scoping methodology.

2.1.3.1 Implementing Procedures and Documentation Sources Used for Scoping and Screening

2.1.3.1.1 Summary of Technical Information in the Application

The applicant had developed implementing procedures used to identify SSCs within the scope of license renewal and SCs subject to an AMR to implement the processes described in LRA Sections 2.0 and 2.1. Additionally, the applicant's implementing procedures provide guidance on the review and consideration of CLB documentation sources, relative to the requirements of 10 CFR 54.4, "Scope," and 10 CFR 54.21, "Contents of Application – Technical Information."

LRA Section 2.1.2, "Information Sources Used for Scoping and Screening," lists the following information sources for the license renewal scoping and screening process:

- updated final safety analysis report (UFSAR)
- fire protection report (FPR)
- environmental qualification (EQ) master list
- maintenance rule database
- engineering drawings
- controlled plant component database

2.1.3.1.2 Staff Evaluation

<u>Scoping and Screening Implementing Procedures</u>. The staff reviewed the applicant's scoping and screening methodology implementing procedures, including license renewal guidelines, documents, and reports, as documented in the staff's audit report, to ensure that the guidance is

consistent with the requirements of the Rule, the SRP-LR and Regulatory Guide 1.188, Revision 1, "Standard Format and Content for Applications to Renew Nuclear Plant Operating Licenses," dated September 2005, which endorses the use of NEI 95-10. The staff determined that the overall process used to implement the 10 CFR Part 54 requirements described in the implementing procedures, including license renewal guidelines, documents, and reports, is consistent with the Rule, the SRP-LR, and the endorsed industry guidance.

The applicant's implementing procedures contain guidance for determining plant SSCs within the scope of the Rule and SCs contained in systems within the scope of license renewal that 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 contained in the LRA, including the implementation of U.S. Nuclear Regulatory Commission (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 described in LRA Section 2.1 and that the methodology is sufficiently detailed in the implementing procedures to provide concise guidance on the scoping and screening process to be followed during the LRA activities.

Sources of Current Licensing Basis Information. The regulation at 10 CFR 54.21(a)(3) requires, for each SC determined to be subject to an AMR, demonstration 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. The regulation at 10 CFR 54.3(a) defines the CLB, in part, as the set of 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, and design basis information (documented in the most recent UFSAR). 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. The staff considered 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 and SCs subject to an AMR.

During the scoping and screening methodology audit, 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 staff reviewed pertinent information sources used by the applicant, including the UFSAR, CLB documents, FPR, EQ master list, maintenance rule database, engineering drawings, and controlled plant component database.

During the audit, the staff discussed the applicant's administrative controls for the controlled plant component database and the other information sources used to verify system information. These controls are described and implemented by plant procedures. Based on a review of the administrative controls and a sample of the system classification information contained in the applicable documentation, the NRC staff determined that the applicant has established adequate measures to control the integrity and reliability of system identification and safety classification data; therefore, the staff determined that the information sources used by the applicant during the scoping and screening process provided a controlled source of system and component data to support scoping and screening evaluations.

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 requirements of 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping evaluations. The staff determined that the design documentation sources, which the applicant's implementing procedures must use, provided sufficient information to ensure that the applicant identified SSCs to be included within the scope of license renewal consistent with the plant's CLB.

2.1.3.1.3 Conclusion

Based on its review of LRA Sections 2.0 and 2.1, the scoping and screening implementing procedures, and the results from the scoping and screening audit, the staff concludes that the applicant's use of implementing procedures and consideration of document sources, including CLB information, is 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 controls used by the applicant to ensure that the scoping and screening methodology used to develop the LRA were adequate for the activity. The applicant used quality control processes during the LRA development to do the following:

- Perform scoping and screening activities using approved documents and procedures.
- Use databases to guide and support scoping and screening and to generate license renewal documents.
- Employ standard processes for scoping, screening, and LRA preparation.
- Use processes and procedures that incorporate preparation, review, comment, and owner acceptance.
- Incorporate industry lessons learned and requests for additional information (RAIs) from other LRA reviews.
- Perform external assessments, including a peer review and benchmarking to recent LRA reviews.
- Perform internal management assessments.

The staff performed a review of implementing procedures and guides, examined the applicant's documentation of activities in reports, reviewed the applicant's activities that were performed to assess the quality of the LRA, and held discussions with the applicant's license renewal management and staff. The staff determined that the applicant's activities provide assurance that the LRA was developed consistent with the applicant's license renewal program requirements.

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 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 are adequate to ensure 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 training process used by the applicant for license renewal project personnel to confirm that it was appropriate for the activity. As outlined in the implementing procedures, the applicant had required training for personnel participating in the development of the LRA and used trained and qualified personnel to prepare the scoping and screening implementing procedures and to perform scoping and screening activities.

License renewal project personnel had been trained using license renewal project procedures and other relevant license renewal information, as appropriate to their functions. Training topics had included 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," relevant NRC and industry guidance documents, lessons learned from other LRA reviews, and applicable implementing procedures.

The staff discussed training activities with the applicant's management and license renewal project personnel and performed a sampling review of applicable documentation. The staff determined that the applicant had developed and implemented adequate controls for the training of personnel performing LRA activities.

2.1.3.3.2 Conclusion

On the basis of discussions with the applicant's license renewal 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 developed and implemented adequate procedures to train personnel 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 Sections 2.0 and 2.1, a review of the applicant's scoping and screening implementing procedures, discussions with the applicant's license renewal personnel, review of the quality controls applied to the LRA development, training of personnel participating in the LRA development, 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, "Scoping and Screening Methodology," describes the applicant's methodology used to identify SSCs within the scope of license renewal pursuant to the requirements of the 10 CFR 54.4(a) criteria. The LRA states that the scoping process identified the SSCs that are safety related and perform and support an intended function for responding to a design basis event (DBE), that are nonsafety related whose failure could prevent accomplishment of a safety-related function, or that support a specific requirement for one of the regulated events applicable to license renewal. In addition, the LRA states that the scoping methodology used was consistent with 10 CFR Part 54 and with the industry guidance contained in NEI 95-10.

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

The applicant addressed the methods used to identify SSCs that are included within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(1) in LRA Section 2.1.5.1, "Safety-Related—10 CFR 54.4(a)(1)," which states:

> At LSCS, the safety-related plant components are identified in controlled engineering drawings and summarized in the PassPort equipment database. The safety-related classifications in the LSCS PassPort equipment database were populated using a controlled procedure, with classification criteria consistent with the above 10 CFR 54.4(a)(1) criteria.

2.1.4.1.2 Staff Evaluation

In accordance with 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied on to remain functional during and following a DBE to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary (RCPB), (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 Part 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance," as applicable.

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

> The set of design basis events as defined in the rule is not limited to Chapter 15 (or equivalent) of the UFSAR. Examples of design basis events 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 design basis events 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 systems, structures, and components that are relied on to remain functional during and following design basis events (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 (anticipated operational occurrences, design basis accidents (DBAs), external events, and natural phenomena) that were applicable to LSCS. The staff reviewed the applicant's basis documents that describe design basis conditions in the CLB and address events defined by 10 CFR 50.49(b)(1) and 10 CFR 54.4(a)(1). The UFSAR and basis documents discuss 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 staff determined that the applicant performed scoping of SSCs for the 10 CFR 54.4(a)(1) criterion in accordance with the license renewal implementing procedures, which provide 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 applicant's CLB definition of safety related met the definition of safety related specified in the Rule.

The staff reviewed a sample of the license renewal scoping results for the ECW system and corresponding structures 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 the sampled systems and structures consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results and the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs that are required to be within the scope of license renewal in accordance with the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.3 Conclusion

On the basis of its review of the LRA and the applicant's implementing procedures and reports, review of a system on a sampling basis, and discussions with the applicant, the staff concludes that the applicant's methodology for identifying safety-related SSCs relied on to remain functional during and following DBEs and for including the SSCs within the scope of license renewal 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

The applicant addressed the methods used to identify SSCs included within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(2).

LRA Section 2.1.5.2, "Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)," states, in part:

> <u>Functional Support for Safety-Related SSC[s] 10 CFR 54.4(a)(1) Functions</u>
>
> The LSCS UFSAR and other CLB documents were reviewed to identify nonsafety-related systems or structures required to support satisfactory accomplishment of a safety-related function. Nonsafety-related systems or structures credited in CLB documents to support a safety-related function have been included within the scope of license renewal.

Connected to and Provide Structural Support for Safety-Related SSCs

For nonsafety-related SSCs directly connected to safety-related SSCs the nonsafety-related piping and supports, up to and including the first seismic or equivalent anchor (such as a series of supports that have been evaluated as a part of a plant-specific piping design analysis to ensure that forces and moments are restrained in three (3) orthogonal directions) beyond the safety/nonsafety interface, are within the scope of license renewal per 10 CFR 54.4(a)(2). The "first seismic or equivalent anchor" is defined such that the failure in the nonsafety-related pipe run beyond the first seismic or equivalent anchor will not render the safety-related portion of the piping unable to perform its intended function under CLB design conditions.

Potential for Spatial Interactions with Safety-Related SSCs

Nonsafety-related systems that are not connected to safety-related piping or components, or are outside the structural support boundary for the attached safety-related piping system, and have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC intended function, must be evaluated for license renewal scope in accordance with 10 CFR 54.4(a)(2) requirements.

The preventive option assumes potential spatial interaction in structures or portions of structures that contain active or passive SSCs that have safety-related functions. The structures of concern for potential spatial interaction were identified based on a review of the CLB to determine which structures contained active or passive safety-related SSCs. Plant walkdowns were performed as required to confirm that all structures containing safety-related SSCs were identified. With the exception of the Turbine Building and Offgas Building, it was assumed that all nonsafety-related SSCs within these structures were located in proximity to safety-related SSCs where potential spatial interaction could occur.

The Turbine Building and Offgas Building have few areas containing safety-related SSCs. Mitigative features were used to prevent spatial interaction between these safety-related SSCs and nonsafety-related SSCs in other areas. No credit was taken for separation by distance alone without a mitigative feature capable of preventing the spatial interaction. The mitigative features were included in the scope of license renewal.

2.1.4.2.2 Staff Evaluation

Regulatory Guide 1.188, Revision 1, endorses the use of NEI 95-10, Revision 6, which discusses the implementation of the staff's position on 10 CFR 54.4(a)(2) scoping criteria, to include nonsafety-related SSCs that may have the potential to prevent satisfactory accomplishments of safety-related intended functions. This includes nonsafety-related SSCs connected to safety-related SSCs, nonsafety-related SSCs in proximity to safety-related SSCs, and mitigative and preventative options related to nonsafety-related and safety-related SSCs interactions. LRA Section 1.5, "Application Structure," states that the applicant's methodology is consistent with the guidance contained in Revision 6 to NEI 95-10 Appendix F.

In addition, the staff's position (as discussed in SRP-LR Section 2.1.3.1.2, "Nonsafety-Related," scoping review procedures) is that applicant 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 2.1.5.2 in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant's implementing procedure and results report, which document the guidance and corresponding results of the applicant's scoping review pursuant to 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC. The staff reviewed LRA Section 2.1.5.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure that describe the method used to identify nonsafety-related SSCs that are required to perform a function that supports a safety-related SSC intended function within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff confirmed that the applicant had reviewed the UFSAR, plant drawings, the controlled plant component database, and other CLB documents 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 staff determined that the applicant had identified the nonsafety-related SSCs that perform a safety function or that support a safety system that would require the nonsafety-related SSC to be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The staff determined that the applicant's methodology for identifying nonsafety-related systems that perform functions that support safety-related intended functions, for inclusion within the scope of license renewal, was in accordance with the guidance of the SRP-LR and the requirements of 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs. The staff reviewed LRA Section 2.1.5.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure that describe the method used to identify nonsafety-related SSCs, which are directly connected to safety-related SSCs, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant had reviewed the safety- to nonsafety-related interfaces for each mechanical system to identify the nonsafety-related components located between the safety- to nonsafety-related interface and license renewal structural boundary.

The staff determined that the applicant had used a combination of the following to identify the portion of nonsafety-related piping systems to include within the scope of license renewal:

- seismic anchors
- equivalent anchors
- bounding conditions described in Revision 6 to NEI 95-10 Appendix F (base-mounted component, flexible connection, inclusion to the free end of nonsafety-related piping, inclusion of the entire piping run or a branch line off of a header where the moment of inertia of the header is greater than 7 times the moment of inertia of the branch)

The staff determined that the applicant's methodology for identifying and including nonsafety-related SSCs directly connected to safety-related SSCs, within the scope of license renewal, was in accordance with the guidance of the SRP-LR and the requirements of 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs. The staff reviewed LRA Section 2.1.5.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure that describe the method used to identify nonsafety-related SSCs, with the potential for spatial interaction with safety-related SSCs, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff determined that the applicant had, with the exception of the Turbine Building and Offgas Building discussed below, 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 described in the LRA as a structure or a portion of a structure that contains active or passive safety-related SSCs.

The staff determined that for the Turbine Building and Offgas Building, each building has several locations containing safety-related SSCs. The applicant had performed a review of the safety-related SSCs within these buildings to determine whether the failure of nonsafety-related SSCs could impact the ability of safety-related SSCs to perform their intended functions. The applicant had identified certain safety-related SSCs located within a portion of a structure whose ability to perform its intended function could be impacted by the failure of nonsafety-related SSCs and included the nonsafety-related SSCs within the scope of license renewal. Additional safety-related SSCs were determined to be protected from the failure of nonsafety-related SSCs by mitigating features, such as pipe conduits or separation by a surface providing spray and drip shielding. The mitigating features were included within the scope of license renewal. The applicant determined that, for the remaining safety-related components, either the failure of the safety-related SSC would cause it to attain a fail-safe state or the component was identified as safety related in the plant component database but did not have a safety-related intended function; therefore, these components did not require the inclusion of nonsafety-related SSCs within the scope of license renewal.

The staff determined that the applicant's methodology for identifying and including nonsafety-related SSCs, with the potential for spatial interaction with safety-related SSCs, within the scope of license renewal was in accordance with the guidance of the SRP-LR and the requirements of 10 CFR 54.4(a)(2).

2.1.4.2.3 Conclusion

On the basis of its review of the LRA and the applicant's implementing procedures and reports, review of a system on a sampling basis, and discussions with the applicant, the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of the intended functions of safety-related SSCs, within the scope of license renewal, is in accordance with the requirements of 10 CFR 54.4(a)(2) 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

The applicant addressed the methods used to identify SSCs included within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(3).

LRA Section 2.1.5.3, "Regulated Events—10 CFR 54.4(a)(3)," states:

> In accordance with 10 CFR 54.4(a)(3), the systems, structures, and components within the scope of license renewal include: All systems, structures and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63).

LRA Section 2.1.5.3 also states:

> The regulation for pressurized thermal shock (10 CFR 50.61) is applicable to pressurized water reactors only, and therefore not applicable to LSCS which is a boiling water reactor. For each of the four [applicable] regulations, a technical basis document was prepared to provide input into the scoping process. Each of the regulated event basis documents (described in Section 2.1.3.4 [of the LRA]) identify the systems and structures that are relied upon to demonstrate compliance with the applicable regulation. The basis documents also identify the source documentation used to determine the scope of components within the system that are credited to demonstrate compliance with each of the applicable regulated events. Guidance provided by the technical basis documents was incorporated into the system and structure scoping evaluations, to determine the SSCs credited for each of the regulated events. SSCs credited in the regulated events have been classified as satisfying criteria of 10 CFR 54.4(a)(3) and have been included within the scope of license renewal.

2.1.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.1.5.3, which describes the method used to identify, and to include within the scope of license renewal, those SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48, "Fire Protection"); EQ (10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants"); pressurized thermal shock (10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events"); anticipated transients without scram (ATWS) (10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants"); and station blackout (SBO) (10 CFR 50.63, "Loss of All Alternating Current Power"). As part of this review during the scoping and screening methodology audit, the staff had discussions with the applicant and reviewed implementing procedures, technical basis documents, license renewal drawings, and scoping results reports. The staff determined that the applicant had evaluated CLB information to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3) and had included these SSCs within the scope of license renewal as documented in the scoping reports. In addition, the staff determined that the scoping report results referenced the information sources used for determining the SSCs credited for compliance with the events.

Fire Protection. The staff reviewed the applicant's implementing procedure and technical basis document that describe the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (10 CFR 50.48, "Fire Protection"). The implementing procedure describes a process that considered CLB information, including the UFSAR and the fire protection technical basis document. The staff reviewed applicable portions of the LRA, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. In addition, the staff reviewed a selected sample of scoping reports for the systems and structures identified in the technical basis document. Based on its review of the CLB documents and the sample report review, the staff determined that the applicant's methodology was adequate for identifying and including SSCs credited in performing fire protection functions within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Environmental Qualification. The staff reviewed the applicant's implementing procedure and technical basis document that describe the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (10 CFR 50.49, EQ). The implementing procedure describes a process that considered CLB information, including the UFSAR and the EQ technical basis document. The staff reviewed applicable portions of the LRA, CLB information, EQ program documentation, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. In addition, the staff reviewed a selected sample of scoping reports for the systems and structures identified in the technical basis document. Based on its review of the CLB documents and the sample report review, the staff determined that the applicant's methodology was adequate for identifying and including SSCs credited in performing EQ functions within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Anticipated Transient without Scram. The staff reviewed the applicant's implementing procedure and technical basis document that describe the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (10 CFR 50.62, ATWS). The implementing procedure describes a process that considered CLB information, including the UFSAR and the ATWS technical basis document. The staff reviewed portions of the applicable portions of the LRA, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. In addition, the staff reviewed a selected sample of scoping reports for the systems and structures identified in the technical basis document. Based on its review of the CLB documents and the sample report review, the staff determined that the applicant's methodology was adequate for identifying and including SSCs credited in performing ATWS functions within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Station Blackout. The staff reviewed the applicant's implementing procedure and technical basis document that describe the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (10 CFR 50.63, "Loss of All Alternating Current Power"). The implementing procedure describes a process that considered CLB information, including the UFSAR and the SBO technical basis document. The staff reviewed portions of the applicable portions of the LRA, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. In addition, the staff reviewed a selected sample of scoping reports for the systems and structures identified in the technical basis document. Based on its review of the CLB documents and the sample report review, the staff determined that the applicant's methodology was adequate for identifying and including SSCs credited in performing SBO functions within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

2.1.4.3.3 Conclusion

On the basis of its review of the LRA and the applicant's implementing procedures and reports, reviews of a system on a sampling basis, and discussions with the applicant, the staff concludes that the applicant's methodology for identifying and including SSCs, which are relied on to remain functional during regulated events, is consistent with the SRP-LR and 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. The applicant described the methods used to identify SSCs included within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a) in LRA Section 2.0, which states:

> This section describes the process for identifying structures and components subject to aging management review in the LaSalle County Station (LSCS) license renewal integrated plant assessment. For the systems, structures, and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) requires the license renewal applicant to identify and list those structures and components subject to Aging Management Review (AMR). 10 CFR 54.21(a)(2) further requires that the methods used to implement the requirements of 10 CFR 54.21(a)(1) be described and justified.

2.1.4.4.2 Staff Evaluation

The staff reviewed the applicant's methodology for identifying SSCs within the scope of license renewal to verify that it met the requirements of 10 CFR 54.4, "Scope." The applicant had developed implementing procedures that describe the processes used to identify the systems and structures that are subject to 10 CFR 54.4 review, to determine whether the system or structure performed its intended functions consistent with the criteria of 10 CFR 54.4(a), and to document the activities in scoping results reports. The process defined the plant in terms of systems and structures and was completed for all systems and structures on site to ensure that the entire plant was assessed.

The staff determined that the applicant had identified the SSCs within the scope of license renewal and documented the results of the scoping process in reports in accordance with the implementing procedures. The reports included 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 implementing documents and reports and determined that the applicant's scoping results contained an appropriate level of detail to document the scoping process.

2.1.4.4.3 Conclusion

Based on its review of the LRA, implementing procedures, and a sampling of system scoping results reviewed during the audit, the staff concludes that the applicant's methodology for identifying systems and structures 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 Scoping

2.1.4.5.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify mechanical SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a).

LRA Section 2.1.5, "Scoping Procedure," states, in part:

> The scoping process was initially performed at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). System and structure functions and intended functions were identified from a review of the source CLB documents. In scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions. The in scope boundaries form the basis for identification of the in scope components, which is the first step in the screening process described in Section 2.1.6 [of the LRA].

LRA Section 2.1.5.5, "Scoping Boundary Determination," states, in part:

> Systems and structures that are included within the scope of license renewal are then further evaluated to determine the population of in scope structures and components. This part of the scoping process is also a transition from the scoping process to the screening process. The process for evaluating mechanical systems is different from the process for structures, primarily because the plant design document formats are different. Mechanical systems are depicted primarily on the system piping and instrumentation diagrams (P&ID) that show the system components and their functional relationships.

LRA Section 2.1.5.5 further states, in part:

> For mechanical systems, the mechanical components that support the system intended functions are included within the scope of license renewal and are depicted on the applicable system piping and instrumentation diagram.

2.1.4.5.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.5 and 2.1.5.5, implementing procedures, reports and the CLB source information associated with mechanical scoping. The staff determined that the CLB source information and the implementing procedure guidance used by the applicant were acceptable to identify mechanical SSCs 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 during the scoping and screening methodology audit. 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 process was consistent with the description provided in LRA Sections 2.1.5 and 2.1.5.5 and with the guidance in SRP-LR Section 2.1 and that it was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping reports for the ECW System and the process used to determine whether the system and components met the scoping criteria of 10 CFR 54.4, "Scope." The staff reviewed the implementing procedures, verified that the applicant had used pertinent engineering and licensing information, and discussed the methodology and results with the applicant. As part of the review process, the staff evaluated the system's documented intended functions and the process used to identify system component types. The staff verified that the applicant had identified and highlighted license renewal drawings to identify the license renewal boundaries in accordance with the implementing procedure guidance. Additionally, the staff determined that the applicant had independently verified the results in accordance with the implementing procedures. The staff confirmed that the applicant's license renewal personnel who verified the results had performed independent reviews of the scoping reports and the applicable license renewal drawings. The staff confirmed that the systems and components identified by the applicant were evaluated against the criteria of 10 CFR 54.4(a)(1), (a)(2), and (a)(3). The staff verified that the applicant had used pertinent engineering and licensing information to determine that SSCs were included within the scope of license renewal in accordance with the 10 CFR 54.4(a).

2.1.4.5.3 Conclusion

On the basis of its review of information contained in the LRA and implementing procedures and the sampling review of 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 Scoping

2.1.4.6.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify structural SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a).

LRA Section 2.1.5, "Scoping Procedure," states, in part:

> The scoping process was initially performed at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). System and structure functions and intended functions were identified from a review of the source CLB documents. In scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions. The in scope boundaries form the basis for identification of the in scope components, which is the first step in the screening process described in Section 2.1.6 [of the LRA].

LRA Section 2.1.5.5, “Scoping Boundary Determination,” states, in part:

> Systems and structures that are included within the scope of license renewal are then further evaluated to determine the population of in scope structures and components. This part of the scoping process is also a transition from the scoping process to the screening process.

LRA Section 2.1.5.5 further states, in part:

> For structures, the structural components that are required to support the intended function(s) of the structure, as described in the CLB, are included within the scope of license renewal. The structural components are identified from a review of applicable plant design drawings of the structure.

2.1.4.6.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.5 and 2.1.5.5, implementing procedures, reports, and the CLB source information associated with structural scoping. The staff determined that the CLB source information and the implementing procedure guidance used by the applicant were acceptable to identify structural SSCs 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 during the scoping and screening methodology audit. 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 process was consistent with the description provided in LRA Sections 2.1.5 and 2.1.5.5 and with the guidance in SRP-LR Section 2.1, and that it was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping reports for the ECW System and corresponding structures and the process used to identify SCs that met the scoping criteria of 10 CFR 54.4, “Scope.” The staff reviewed the implementing procedures, verified that the applicant had used pertinent engineering and licensing information, and discussed the methodology and results with the applicant. As part of the review process, the staff evaluated the structure’s documented intended functions and the process used to identify structural component types. Additionally, the staff determined that the applicant had verified the results in accordance with the implementing procedures. The staff confirmed that the applicant’s license renewal personnel who verified the results had performed independent reviews of the scoping reports and the applicable license renewal drawings. The staff confirmed that the SCs identified by the applicant were evaluated against the criteria of 10 CFR 54.4(a)(1), (a)(2), and (a)(3). The staff verified that the applicant had used pertinent engineering and licensing information to determine that systems and components were included within the scope of license renewal in accordance with the 10 CFR 54.4(a)

2.1.4.6.3 Conclusion

On the basis of its review of information contained in the LRA and implementing procedures and the sampling review of scoping results, the staff concludes that the applicant’s methodology for identifying 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 Scoping

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.5, “Scoping Procedure,” states, in part:

> The scoping process was initially performed at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). System and structure functions and intended functions were identified from a review of the source CLB documents. In scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions. The in scope boundaries form the basis for identification of the in scope components, which is the first step in the screening process described in Section 2.1.6 [of the LRA].

LRA Section 2.1.5.5, “Scoping Boundary Determination,” states, in part:

> Systems and structures that are included within the scope of license renewal are then further evaluated to determine the population of in scope structures and components. This part of the scoping process is also a transition from the scoping process to the screening process.

LRA Section 2.1.5.5 further states:

> Electrical and I&C systems, and electrical components within mechanical systems, did not require further system evaluations to determine which components were required to perform or support the identified intended functions. A bounding scoping approach is used for electrical equipment. All electrical components within in scope systems were included within the scope of license renewal. In scope electrical components were placed into commodity groups and were evaluated as commodities during the screening process as described in Section 2.1.6 [of the LRA].

2.1.4.7.2 Staff Evaluation

The staff reviewed LRA Sections 2.1.5 and 2.1.5.5, implementing procedures, reports, and the CLB source information associated with electrical scoping. The staff determined that the CLB source information and implementing procedure guidance used by the applicant was acceptable to identify electrical SSCs 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 during the scoping and screening methodology audit. 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 process was consistent with the description provided in LRA Sections 2.1.5 and 2.1.5.5 and with the guidance in SRP-LR Section 2.1 and that it was adequately implemented.

The staff noted that, after the scoping of electrical and instrumentation and control (I&C) components was performed, the in-scope electrical components were categorized into electrical commodity groups. Commodity groups include electrical and I&C components with common characteristics. Component level intended functions of the component types were identified. As part of this review, the staff discussed the methodology with the applicant, reviewed the implementing procedures developed to support the review, and reviewed the scoping results for a sample of SSCs that were identified within the scope of license renewal. The staff determined that the applicant's scoping included appropriate electrical and I&C components, as well as electrical and I&C components contained in mechanical or structural systems within the scope of license renewal on a commodity basis.

2.1.4.7.3 Conclusion

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

2.1.4.8 Scoping Methodology Conclusion

On the basis of its review of information contained in the LRA and 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 intended functions, and (3) that are necessary to demonstrate compliance with the NRC's regulations for fire protection, EQ, ATWS, and SBO. The staff concluded 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

The applicant addressed the methods used to identify SCs included within the scope of license renewal that are subject to an AMR in accordance with the requirements of 10 CFR 54.21, "Contents of Application – Technical Information," in LRA Section 2.1.6, "Screening Procedure," and LRA Section 2.1.6.1, "Identification of Structures and Components Subject to AMR." LRA Section 2.1.6.1 states, in part:

> Structures and components that perform an intended function without moving parts or without a change in configuration or properties are defined as passive for license renewal. Passive structures and components that are not subject to replacement based on a qualified life or specified time period are defined as long-lived for license renewal. The screening procedure is the process used to identify the passive, long-lived structures and components within the scope of license renewal that are subject to aging management review.
>
> NUREG–1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," and NEI 95-10, Appendix B, were used as the basis for the identification of passive structures and components. Most passive structures and components are long-lived. In the few cases where a passive component is determined not to be long-lived, such determination is documented in the screening evaluation and, if applicable, on the associated license renewal boundary drawing.

> The LSCS structures and components subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1) described above.

2.1.5.1.2 Staff Evaluation

In accordance with 10 CFR 54.21, each LRA must contain an IPA that identifies SCs that are within the scope of license renewal and 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 identify 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, structural, and electrical SCs within the scope of license renewal that are 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). 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, on a sampling basis, the screening results reports for ECW and associated structures. 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, structural, and electrical SCs is discussed in the safety evaluation report (SER) Section 2.1.5.2.

2.1.5.1.3 Conclusion

On the basis of a 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 the SCs that are 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

The applicant addressed the methods used to identify mechanical SCs included within the scope of license renewal that are subject to an AMR in accordance with the requirements of 10 CFR 54.21, "Contents of Application – Technical Information." LRA Section 2.1.6.1 states, in part:

> These system boundary drawings were reviewed to identify the passive, long-lived components, and the identified components were then entered into the license renewal database. Component listings from the Passport equipment database were also reviewed to confirm that all system components were considered. In cases where the system piping and instrumentation diagram did

> not provide sufficient detail, such as for some large vendor supplied components (e.g., compressors, emergency diesel generators, the associated component drawings or vendor manuals were also reviewed. Plant walkdowns were performed when required for confirmation.

2.1.5.2.2 Staff Evaluation

The staff reviewed the applicant's methodology used for mechanical component screening as described in LRA Section 2.1.6.1, implementing procedures, basis documents, and the mechanical scoping and screening reports. The staff determined that the applicant used the screening process described in these documents along with the information contained in NEI 95-10 Appendix B and the SRP-LR to identify the mechanical SCs subject to an AMR.

The staff determined that the applicant had identified SCs that met the passive criteria in accordance with the guidance contained in NEI 95-10. In addition, the staff determined that the applicant had evaluated the identified passive commodities to determine that they were not subject to replacement based on a qualified life or specified time period (long lived) and that the remaining passive, long-lived components were subject to an AMR.

The staff performed a sample review to determine whether the screening methodology outlined in the LRA and implementing procedures was adequately implemented. The staff reviewed the ECW System screening report and basis documents, had discussions with the applicant, and verified proper implementation of the screening process.

2.1.5.2.3 Conclusion

On the basis of its review of information contained in the LRA, implementing procedures, and the sampled mechanical screening results, the staff concludes that the applicant's methodology for identification of mechanical SCs 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.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

The applicant addressed the methods used to identify structural SCs included within the scope of license renewal that are subject to AMR in accordance with the requirements of 10 CFR 54.21, "Contents of Application – Technical Information." LRA Section 2.1.6.1 states, in part:

> The structure screening process also began with the results from the scoping process. For in scope structures, the completed scoping packages include written descriptions of the structure. If only selected portions of the structure are in scope, the in scope portions are described in the scoping evaluation. The associated structure drawings were reviewed to identify the passive, long-lived structures and components, and the identified structures and components were then entered into the license renewal database. Plant walkdowns were performed when required for confirmation.

2.1.5.3.2 Staff Evaluation

The staff reviewed the applicant's methodology used for structural component screening as described in LRA Section 2.1.6.1, implementing procedures, basis documents, and the structural scoping and screening reports. The staff determined that the applicant used the screening process described in these documents along with the information contained in NEI 95-10 Appendix B and the SRP-LR to identify the structural SCs subject to an AMR.

The staff determined that the applicant had identified structural SCs that met the passive criteria in accordance with NEI 95-10. In addition, the staff determined that the applicant evaluated the identified passive commodities to determine that they were not subject to replacement based on a qualified life or specified time period (long lived) and that the remaining passive, long-lived components were determined to be subject to an AMR.

The staff performed a sample review to determine whether the screening methodology outlined in the LRA and implementing procedures was adequately implemented. The staff reviewed the ECW and associated structures screening report and basis documents, had discussions with the applicant, and verified proper implementation of the screening process.

2.1.5.3.3 Conclusion

On the basis of its review of information contained in the LRA, implementing procedures, and the sampled structural screening results, the staff concludes that the applicant's methodology to identify structural SCs 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

The applicant addressed the methods used to identify electrical SCs included within the scope of license renewal that are subject to AMR in accordance with the requirements of 10 CFR 54.21, "Contents of Application – Technical Information." LRA Section 2.1.6.1 states, in part:

> Screening of electrical and I&C components within the in scope electrical, I&C, and mechanical systems used a bounding approach as described in NEI 95-10. Electrical and I&C components for the in scope systems were assigned to commodity groups. The commodities subject to an aging management review are identified by applying the criteria of 10 CFR 54.21(a)(1). This method provides the most efficient means for determining the electrical commodities subject to an aging management review since many electrical and I&C components and commodities are active.

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical component screening as described in LRA Section 2.1.6.1, implementing procedures, basis documents, and the electrical scoping and screening reports. The staff confirmed that the applicant had used the screening process described in these documents along with the information contained in NEI 95-10 Appendix B and the SRP-LR to identify the electrical SSCs subject to an AMR.

The staff determined that the applicant had identified electrical commodity groups that met the passive criteria in accordance with NEI 95-10. In addition, the staff determined that the applicant evaluated the identified passive commodities to determine which ones were not subject to replacement based on a qualified life or specified time period (long lived) and that the remaining passive, long-lived components were determined to be subject to an AMR.

The staff performed a sample review to determine whether the screening methodology outlined in the LRA and implementing procedures was adequately implemented. During the scoping and screening methodology audit, the staff reviewed the electrical screening report and discussed the report with the applicant and verified proper implementation of the screening process.

The staff performed a sample review to determine whether the screening methodology outlined in the LRA and implementing procedures was adequately implemented. During the scoping and screening methodology audit, the staff reviewed electrical screening reports and basis documents, had discussions with the applicant, and verified proper implementation of the screening process.

2.1.5.4.3 Conclusion

On the basis of its review of information contained in the LRA, implementing procedures, and the sampled electrical screening results, the staff concludes that the applicant's methodology to identify electrical SCs 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 Screening Methodology Conclusion

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 was 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, and sample system reviews, the staff confirms that the applicant's scoping and screening methodology is consistent with the requirements of 10 CFR 54.4, "Scope," and 10 CFR 54.21(a)(1). The staff also concludes that the applicant's description and justification of its scoping and 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 SSCs within the scope of license renewal and SCs subject to 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 on to mitigate 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 the LSCS systems, structures, and commodity groups that were evaluated to determine whether they were 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, "Scope."

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 Table 2.2-1 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, "Scope." 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."

The staff sampled the contents of the UFSAR based on the systems and structures listed in LRA Table 2.2-1 to determine whether there were any systems or structures that may have intended functions within the scope of license renewal, as defined by 10 CFR 54.4, but were omitted from the scope of license renewal. The staff did not identify any omissions.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2 and UFSAR 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. Based on its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4.

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 systems within Mechanical Systems in the following LRA sections:

- LRA Section 2.3.1, “Reactor Vessel, Internals, and Reactor Coolant System”
- LRA Section 2.3.2, “Engineered Safety Features Systems”
- LRA Section 2.3.3, “Auxiliary Systems”
- LRA Section 2.3.4, “Steam and Power Conversion System”

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. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, “Scope,” components and supporting structures for mechanical 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 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 UFSAR, 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 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.

2.3.1 Reactor Vessel, Internals, and Reactor Coolant System

LRA Section 2.3.1 identifies the Reactor Vessel, Internals, and Reactor Coolant System SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the Reactor Vessel, Internals, and Reactor Coolant System in the following LRA sections:

- LRA Section 2.3.1.1, “Reactor Coolant Pressure Boundary System”
- LRA Section 2.3.1.2, “Reactor Vessel”
- LRA Section 2.3.1.3, “Reactor Vessel Internals”

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

2.3.1.1 Reactor Coolant Pressure Boundary System

2.3.1.1.1 Summary of Technical Information in the Application

The Reactor Coolant Pressure Boundary (RCPB) System consists of those systems and components that are designed to provide the source of forced circulation of reactor coolant through the reactor core to remove the heat generated by fission. In addition, the RCPB provides a flowpath to the reactor vessel for feedwater, high pressure core spray (HPCS), low pressure core spray (LPCS), residual heat removal (RHR), reactor core isolation cooling (RCIC), reactor water cleanup (RWCU), and main steam system. The above systems in the RCPB consist of pressure-containing/retaining components, such as the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI Class 1 and Class 2 piping and instrumentation. More detailed information of these pressure boundary and associated systems is provided in UFSAR Chapter 5 and Appendix G.

The RCPB license renewal scoping boundary begins at the piping attached to the RPV nozzle safe end to piping welds. The RPV nozzles, safe ends, and welds are included with the license renewal Reactor Vessel System. The RCPB boundary includes the piping connected to the 10 recirculation inlet nozzles, 2 recirculation outlet nozzles, 4 MS nozzles, 6 feedwater nozzles, 3 low pressure coolant injection (LPCI) nozzles, 10 instrumentation nozzles, 2 jet pump instrument nozzles, 1 HPCS nozzle, 1 LPCS nozzle, 1 standby liquid control (SLC) nozzle, 1 bottom head drain nozzle, 1 reactor head vent nozzle, 1 reactor head spray nozzle, and the reactor vessel head seal leak detection nozzle. The RCPB includes the main reactor recirculation flowpath, which begins at the pump suction piping attached to the reactor vessel nozzles, continues through the suction piping, suction valves, recirculation pump casings, discharge valves, and discharge piping to return to the RPV nozzles.

LRA Table 2.3.1-1, “Reactor Coolant Pressure Boundary System,” identifies the component types within the scope of license renewal and subject to AMR.

The intended functions of the RCPB within the scope of license renewal include the following:

- Provide reactor coolant pressure boundary. The RCPB System forms a barrier to minimize the release of reactor coolant and radioactive material to the Reactor Buildings. The RCPB System, in conjunction with the Reactor Protection System, provides overpressure protection for the RCPB (10 CFR 54.4(a)(1)).
- Provide primary containment boundary. The RCPB System includes containment isolation valves (10 CFR 54.4(a)(1)).
- Sense process conditions and generate signals for reactor trip or engineered safety features actuations. The RCPB System includes instrumentation and process controls that provide input signals to the Primary Containment Isolation System, Reactor Protection System, and Emergency Core Cooling System (ECCS) (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The RCPB System includes nonsafety-related fluid-filled lines within the Reactor Building and Primary Containment, which have the potential for spatial interaction with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

Additional details on RCPB intended functions can be found in UFSAR references, UFSAR Section 5, and UFSAR Appendix G.

2.3.1.1.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.1.1, license renewal boundary drawings, and UFSAR Sections 5.0 and 7.7.3. The staff used the evaluation methodology as described in guidance in SRP-LR Section 2.3 and SER Section 2.3.

The staff evaluated the system functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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

Based in its evaluation, the staff concludes that the applicant appropriately identified the RCPB components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the RCPB components subject to an AMR, as required by 10 CFR 54.21(a)(1).

The staff reviewed the LRA and UFSAR 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's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the RCPB 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 Reactor Vessel

2.3.1.2.1 Summary of Technical Information in the Application

LRA Section 2.3.1.2 states that the Reactor Vessel is a normally operating system and is designed to contain pressure and heat generated by the nuclear core and to transfer this heat to the reactor coolant. The Reactor Vessel consists of the cylindrical vessel shell, lower vessel head, vessel support skirt, closure head, nozzles and safe ends, and closure studs and nuts.

The Reactor Vessel interfaces with several other license renewal systems and components, including the Control Rod Drive (CRD) System, Neutron Monitoring System, Primary Containment, RCPB System, Reactor Vessel Internals, and Component Supports Commodity Group.

The purpose of the Reactor Vessel is to maintain the reactor vessel pressure boundary, provide structural support for the reactor vessel internals and core and, along with the Reactor Vessel Internals, provide a floodable volume. The Reactor Vessel provides a boundary to separate fission products from the environment.

The components within the Reactor Vessel license renewal scoping boundary are those that comprise the reactor vessel, including nozzles (with integral safe ends and thermal sleeves), closure studs and nuts, and the vessel support skirt. The vessel top head includes one head vent nozzle, one head spray/RCIC nozzle, one spare nozzle, and four lifting lugs. The cylindrical portion of the vessel includes 1 flange seal leak detection line nozzle, 4 steam outlet nozzles, 6 feedwater inlet nozzles, 1 HPCS nozzle, 1 LPCS nozzle, 1 control rod drive hydraulic system return nozzle, 10 water level instrumentation nozzles, 3 RHR/LPCI nozzles, 10 recirculation inlet nozzles, 2 recirculation outlet nozzles, and 2 jet pump instrument nozzles. The bottom head includes 1 core differential pressure/SLC nozzle, 1 drain nozzle, 185 control rode drive penetrations, and 55 incore flux monitor penetrations.

The system is required for plant startup, normal plant operation, and normal shutdown.

More details regarding the Reactor Vessel are provided in LRA Section 2.3.1.2 and UFSAR Section 5.3.

The intended functions of the Reactor Vessel within the scope of license renewal include the following:

- Provide reactor coolant pressure boundary. The Reactor Vessel forms a barrier against the release of reactor coolant and radioactive material to the Reactor Building (10 CFR 54.4(a)(1)).
- Maintain reactor core assembly geometry. The Reactor Vessel provides support to the Reactor Vessel Internals. The Reactor Vessel, along with the Reactor Vessel Internals, maintains a floodable volume within the reactor (10 CFR 54.4(a)(1)).
- Provide structural support or restraint to SSCs in the scope of license renewal. The reactor pressure vessel support skirt and stabilizer brackets provide structural support for the reactor vessel. The refueling bellows bracket provides support for the refueling bellows (10 CFR 54.4(a)(1)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.1-2, "Reactor Vessel, Components Subject to Aging Management Review," lists the component types that require AMR and their intended functions.

2.3.1.2.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.1.2, license renewal boundary drawings, and UFSAR Section 5.3. The staff used the evaluation methodology described in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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

Based on its review of LRA Section 2.3.1.2 and the UFSAR, the staff concludes that the applicant appropriately identified the Reactor Vessel components within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the Reactor Vessel components subject to AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Vessel Internals

2.3.1.3.1 Summary of Technical Information in the Application

The Reactor Vessel Internals is a normally operating system within the Reactor Vessel that is designed to control the generation of heat in the reactor core, to transfer this heat to the reactor coolant, and to supply dry steam to the main steam system. The Reactor Vessel Internals include the core that contains fuel assemblies that generate the heat; control rods and CRD assemblies that control reactivity in the core; and neutron flux detector assemblies that monitor core reactivity, the core shroud, and associated supports and hardware core spray piping, incore instrumentation, and the steam dryer assembly.

The purpose of the Reactor Vessel Internals is to maintain reactor core assembly geometry, to achieve and maintain the reactor core subcritical for any mode of normal operation or event, to control reactivity in the nuclear reactor core, and to maintain core thermal and hydraulic limits.

More detailed information regarding the Reactor Vessel Internals information and its boundary are provided in UFSAR Sections 3.9.5 and 4.1.2.

The intended functions of the Reactor Vessel Internals within the scope of license renewal include the following:

- Maintain reactor core assembly geometry. The reactor internal components, in conjunction with the reactor pressure vessel, are designed to provide physical support to maintain fuel configuration and clearances to ensure core reactivity control and core cooling capability during normal and accident conditions (10 CFR 54.4(a)(1)).
- Introduce negative reactivity to achieve and maintain subcritical reactor condition. The control rods and CRD assemblies adjust the concentration of the neutron absorber in the core during normal operations and shutdown conditions (10 CFR 54.4(a)(1)).
- Introduce emergency negative reactivity to make the reactor subcritical. When a Reactor Protection System scram signal is received, high-pressure water is applied to the CRD assemblies to rapidly insert each control rod into the core. The core plate differential pressure and standby liquid control line provides a flowpath for injecting a neutron absorber into the reactor core when control rods are unavailable (10 CFR 54.4(a)(1)).
- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. Neutron flux detectors within the reactor core initiate a Reactor Protection System scram signal to shut down the reactor upon a high flux condition (10 CFR 54.4(a)(1)).
- Provide emergency core cooling where the equipment provides coolant directly to the core. The low pressure coolant injection couplings and core spray piping and spargers

distribute emergency core cooling flow within the shroud to the reactor core (10 CFR 54.4(a)(1)).

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The nonsafety-related steam dryer could interact with safety-related components (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.1-3, "Reactor Vessel Internals," lists the component types of the Reactor Vessel Internals that require AMR and their intended functions.

Additional details for components subject to AMR are provided in the UFSAR sections identified above.

2.3.1.3.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.1.3, license renewal boundary drawings, and UFSAR Sections 3.9.5 and 4.1.2. The staff used the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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

Based on its review of the LRA Section 2.3.1.3 and the UFSAR, the staff concludes that the applicant appropriately identified the Reactor Vessel Internals that are within the scope of license renewal, as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified the Reactor Vessel Internals components subject to AMR, as required by 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features Systems

LRA Section 2.3.2 identifies the Engineered Safety Features Systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the Engineered Safety Features Systems in the following LRA sections:

- LRA Section 2.3.2.1, "High Pressure Core Spray System"
- LRA Section 2.3.2.2, "Low Pressure Core Spray System"
- LRA Section 2.3.2.3, "Reactor Core Isolation Cooling System"
- LRA Section 2.3.2.4, "Residual Heat Removal System"
- LRA Section 2.3.2.5, "Standby Gas Treatment System"

The staff's findings on review of LRA Sections 2.3.2.1 – 2.3.2.5 are in SER Sections 2.3.2.1 – 2.3.2.5, respectively.

2.3.2.1 High Pressure Core Spray System

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 describes the High Pressure Core Spray (HPCS) System as a standby ECCS system designed to deliver cooling water to the RPV and to maintain fuel cladding temperature below fragmentation in the event of small and large pipe breaks within the RCPB. After a pipe break, the system delivers water to the RPV though core spray spargers to the top surface of the core and depressurizes the reactor.

The HPCS System consists of a single motor-driven pump and associated piping, valves, and spray spargers. The HPCS System receives cooling water supply from the suppression pool. The system operates automatically when it receives signals on reactor low water level or drywell high pressure signal.

More details regarding the HPCS System are provided in LRA Section 7.3.1.2.1 and UFSAR Section 6.3.2.2.1.

The intended functions of the HPCS System within the scope of license renewal include the following:

- Provide primary containment boundary. The HPCS System includes safety-related primary containment isolation valves on the HPCS suction from the suppression pool, HPCS relief valve discharge piping, and the HPCS full flow test and minimum flow lines (10 CFR 54.4(a)(1)).
- Provide emergency core cooling where the equipment provides coolant directly to the core. The HPCS System provides core cooling following a break in the reactor coolant pressure boundary by delivering water from the suppression pool through nozzles in a circular sparger located above and around the core periphery (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The HPCS System contains nonsafety-related water-filled lines in the Reactor Building that have potential spatial and structural interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.2-1, "HPCS System," lists the components that are subject to an AMR. Additional details for components subject to an AMR are provided in the UFSAR sections identified above.

2.3.2.1.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.2.1, license renewal drawings, and UFSAR Sections 6.3.2.2.1 and 7.3.1.2.1. The staff used the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.3.2.1.3 Conclusion

Based on its evaluation, the staff concludes that the applicant appropriately identified the HPCS SSCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified HPCS SSCs subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.2.2 Low Pressure Core Spray System

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 describes the Low Pressure Core Spray System (LPCS) as a standby system designed to provide core cooling following a break in the RCPB that would rapidly depressurize the reactor vessel. The LPCS is also designed to provide core cooling following a small break in which the automatic depressurization system (ADS) or HPCS has operated to lower the reactor vessel pressure to the operating range of the LPCS. The system accomplishes these tasks by delivering water from the suppression pool to the RPV through nozzles in a circular sparger (separate from the HPCS sparger) located above and around the core periphery.

The LPCS is automatically actuated by reactor vessel low water level or drywell high pressure, or can be manually actuated from the control room. The ADS is interlocked with the LPCS by means of pressure switches located in the pump discharge piping upstream of the pump discharge check valves. The pump discharge pressure is used as a permissive for automatic initiation of ADS. This ensures that the LPCS pump has received electrical power, has started, and is capable of delivering water into the vessel prior to vessel depressurization.

The LPCS includes safety-related primary containment isolation valves on the LPCS suction from the suppression pool, the LPCS relief valve discharge piping, and the LPCS full flow test and minimum flow lines.

For further details, see LRA Section 2.3.2.2 and UFSAR Section 6.3.2.2.3.

The intended functions of the LPCS system within the scope of license renewal include the following:

- Provide primary containment boundary. The LPCS includes safety-related primary containment isolation valves on the LPCS suction from the suppression pool, LPCS relief valve discharge piping, and the LPCS full flow test and minimum flow lines (10 CFR 54.4(a)(1)).
- Provide emergency core cooling where the equipment provides coolant directly to the core. The LPCS provides core cooling following a break in the reactor coolant pressure boundary by delivering water from the suppression pool through nozzles in a circular sparger located above and around the core periphery (10 CFR 54.4(a)(1)).

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. LPCS pump discharge pressure is used as a permissive for automatic initiation of ADS (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The LPCS contains nonsafety-related water-filled lines in the Reactor Building that have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.2-2, "Low Pressure Core Spray System," lists the components that are subject to an AMR.

Additional details for components subject to AMR are provided in the UFSAR sections identified above.

2.3.2.2.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.2.2, license renewal boundary drawings, and UFSAR Sections 6.3.2.2.3 and 7.3.1.2.2. The staff used the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and the UFSAR and verified 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 being within the scope of license renewal to verify that it 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

Based on its evaluation, the staff concludes that the applicant appropriately identified the LPCS SSCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified LPCS SSCs subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.2.3 Reactor Core Isolation Cooling System

2.3.2.3.1 Summary of Technical Information in the Application

The Reactor Core Isolation Cooling (RCIC) System is a standby system designed to prevent reactor fuel from overheating under conditions in which (1) the reactor vessel is isolated and maintained in the hot standby condition, (2) the reactor vessel is isolated and accompanied by loss of the coolant flow from the reactor feedwater system, or (3) the reactor vessel is shut down under condition of loss of the normal feedwater system and before operation of the shutdown cooling system. The RCIC System is a nonsafety system; therefore, it has no safety design bases. However, it is included in license renewal because it supplies makeup water to the reactor vessel when it is isolated.

The RCIC System operates automatically to maintain sufficient coolant in the reactor vessel when it is isolated under the conditions described above. During operation, the turbine-driven pump takes suction from the cycled condensate storage tank or suppression pool and injects water into the RPV via the head spray nozzle of the RPV. There is an automatic suction source switchover to the suppression pool when the cycled condensate storage tank is exhausted.

The RCIC System consists of a turbine-driven pump, piping, valves, accessories, and instrumentation capable of delivering makeup water to the reactor vessel to maintain sufficient reactor water inventory and adequate core cooling. The RCIC System is automatically initiated at a predetermined low reactor water level, or it can be manually initiated. The RCIC turbine steam supply comes from the RPV just upstream of the main steam isolation valves (MSIVs).

More details regarding the RCIC System are provided in LRA Section 2.3.1.3 and UFSAR Sections 5.4.6 and 7.4.1.

The intended functions of the RCIC System within the scope of license renewal include the following:

- Remove residual heat from the reactor coolant system. The RCIC System is capable of maintaining sufficient coolant inventory in the reactor vessel in case of an isolation with a loss of main feedwater flow (10 CFR 54.4(a)(1)).
- Provide primary containment boundary. The RCIC System includes safety-related primary containment isolation valves on the RCIC suction from the suppression pool, HPCS relief valve discharge piping, and the RCIC full flow test and minimum flow lines (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The RCIC System includes nonsafety-related water-filled lines in the Reactor Buildings that have the potential for spatial interactions (spray or leakage) or structurally interact with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.2-3 lists the component types for the RCIC System that require an AMR and their intended functions.

Additional details for components subject to AMR are provided in the UFSAR sections identified above.

2.3.2.3.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.2.3, license renewal boundary drawings, and UFSAR Sections 5.4.6 and 7.4.1. The staff used the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and the UFSAR and verified 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 being within the scope of license renewal to verify that it 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

Based on its evaluation, the staff concludes that the applicant appropriately identified the RCIC SSCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified RCIC SSCs subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.2.4 Residual Heat Removal System

2.3.2.4.1 Summary of Technical Information in the Application

The Residual Heat Removal (RHR) System operates in three modes: (1) LPCI mode, (2) shutdown cooling and reactor vessel head spray mode, and (3) steam condensing mode. The LPCI function of the RHR is designed to provide cooling to the reactor core when the reactor pressure is low, such as for a large loss-of-coolant accident (LOCA) break. However, LPCI operation extends to a small break LOCA when it operates in conjunction with the ADS and HPCS Systems. This mode of operation is an integral part of the RHR System, and it operates during normal shutdown and cooldown. The shutdown cooling and RPV head spray mode maintains the reactor core in a cold shutdown condition and meets the requirements of long-term heat removal. This mode is used to remove decay heat and to cool the reactor for maintenance and refueling. According to the LSCS UFSAR, an onsite review was performed and it deleted the steam condensing mode of operation, the details of which are provided in Section 5.4.7.2.2.3 of the UFSAR.

More details regarding the RHR System are provided in LRA Section 2.3.1.4 and UFSAR Sections 5.4.7 and 6.3.2.

The intended functions of the RHR System within the scope of license renewal include the following:

- Provide primary containment boundary. The RHR System provides safety-related primary containment isolation capability on containment spray discharge, suppression pool suction, and test return lines penetrating the primary containment (10 CFR 54.4(a)(1)).
- Remove residual heat from the reactor coolant system. The RHR System removes decay and sensible heat from the reactor primary system (10 CFR 54.4(a)(1)).
- Provide emergency core cooling where the equipment provides coolant directly to the core. The RHR System provides water from the suppression pool to be injected directly into the core region of the reactor vessel following a LOCA (10 CFR 54.4(a)(1)).
- Provide emergency heat removal from primary containment and provide containment pressure control. The RHR System provides for maintaining the suppression pool temperature below required limits following a reactor blowdown. The RHR System also provides for spraying the drywell and suppression pool vapor spaces to maintain internal pressure below design limits (10 CFR 54.4(a)(1)).

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The RHR System provides for associated actuation and system protection logic for engineered safety features operation (10 CFR 54.4(a)(1)).
- Ensure adequate cooling in the spent fuel pool to maintain stored fuel within acceptable temperature limits. The RHR System provides additional cooling capacity for fuel pool cooling (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The RHR System contains nonsafety-related fluid-filled lines within the Reactor Buildings that have the potential for spatial interaction with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.2-4 lists the RHR System component types that require an AMR and their intended functions.

Additional details for components subject to an AMR are provided in the UFSAR sections identified above.

2.3.2.4.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.2.4, license renewal drawings, and UFSAR Sections 5.4.7, 6.3.1, and 6.3.2. The staff used the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff evaluated the system functions described in the LRA and the UFSAR and verified 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 being within the scope of license renewal to verify that it 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

Based on its evaluation, the staff concludes that the applicant appropriately identified the RHR SSCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concluded that the applicant adequately identified RHR System SSCs subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.2.5 Standby Gas Treatment System

2.3.2.5.1 Summary of Technical Information in the Application

LRA Section 2.3.2.5 states that the purpose of the Standby Gas Treatment (SGT) System is to reduce the amount of halogen and particulate in gases leaking from the primary containment, which are potentially present in the secondary containment following an accident. The system can also be used as an alternate method to purge the primary containment. The SGT System also controls releases from postulated fuel-handling accidents.

When the system is initiated, it takes suction from the secondary containment and treats the air, which is then released to the environment through the plant stack at an elevated release point. The SGT System maintains a slightly negative secondary containment pressure in order to prevent untreated air leakage from being released to the environment. The SGT System is safety related and powered from essential buses. The SGT System functions during a design basis LOCA with a simultaneous loss of offsite power. The system is normally in standby, and automatically starts and operates during DBAs.

Two independent SGT subsystems are shared between Units 1 and 2. Each subsystem consists of ductwork, dampers, charcoal filter train, and isolation and control dampers, interconnecting pipes, and associated instrumentation. The charcoal filter trains consist of a filter unit fan and cooling fan, a demister, an electric heater, a prefilter bank, two high-efficiency particulate air filter banks, and a charcoal adsorber.

The intended functions of the SGT System within the scope of license renewal include the following:

- Control and treat radioactive materials released to the secondary containment. The SGT System maintains a negative pressure within secondary containment, and reduces halogen and particulate concentrations in gases potentially present in the secondary containment following an accident prior to release to the environment (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The SGT System includes nonsafety-related piping that structurally interacts with safety-related SSCs, and water-filled components that have the potential for spatial interactions (spray or leakage) with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for EQ (10 CFR 50.49) (10 CFR 54.4(a)(3)).

LRA Table 2.3.2-5 identifies the SGT System component types within the scope of license renewal and subject to an AMR.

2.3.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.5, UFSAR Sections 6.5.1 and 7.3.8, LRA Table 3.2.2-5, and the license renewal boundary 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 the UFSAR 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 being within the scope of license renewal to verify that it 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).

2.3.2.5.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the SGT System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

LRA Section 2.3.3 identifies the Auxiliary Systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the Auxiliary Systems in the following LRA sections:

- LRA Section 2.3.3.1, "Closed Cycle Cooling Water System"
- LRA Section 2.3.3.2, "Combustible Gas Control System"
- LRA Section 2.3.3.3, "Compressed Air System"
- LRA Section 2.3.3.4, "Control Rod Drive System"
- LRA Section 2.3.3.5, "Control Room Ventilation System"
- LRA Section 2.3.3.6, "Cranes, Hoists and Refueling Equipment System"
- LRA Section 2.3.3.7, "Demineralized Water Makeup System"
- LRA Section 2.3.3.8, "Diesel Generator and Auxiliaries System"
- LRA Section 2.3.3.9, "Drywell Pneumatic System"
- LRA Section 2.3.3.10, "Electrical Penetration Pressurization System"
- LRA Section 2.3.3.11, "Essential Cooling Water System"
- LRA Section 2.3.3.12, "Fire Protection System"
- LRA Section 2.3.3.13, "Fuel Pool Cooling and Storage System"
- LRA Section 2.3.3.14, "Nonessential Cooling Water System"
- LRA Section 2.3.3.15, "Nonsafety-Related Ventilation System"
- LRA Section 2.3.3.16, "Plant Drainage System"
- LRA Section 2.3.3.17, "Primary Containment Ventilation System"
- LRA Section 2.3.3.18, "Process Radiation Monitoring System"
- LRA Section 2.3.3.19, "Process Sampling and Post Accident Monitoring System"
- LRA Section 2.3.3.20, "Radwaste System"
- LRA Section 2.3.3.21, "Reactor Water Cleanup System"
- LRA Section 2.3.3.22, "Safety-Related Ventilation System"
- LRA Section 2.3.3.23, "Standby Liquid Control System"
- LRA Section 2.3.3.24, "Suppression Pool Cleanup System"
- LRA Section 2.3.3.25, "Traversing Incore Probe System"

The staff's findings on review of LRA Sections 2.3.3.1 – 2.3.3.25 are in SER Sections 2.3.3.1 – 2.3.3.25, respectively.

2.3.3.1 Closed Cycle Cooling Water System

2.3.3.1.1 Summary of Technical Information in the Application

The Closed Cycle Cooling Water (CCW) System includes the reactor building closed cooling water (RBCCW) system and turbine building closed cooling water (TBCCW) system. The CCW

System is in scope for license renewal. However, portions of the CCW System do not perform intended functions and are not in scope. The CCW System is a normally operating closed cooling water system designed to provide cooling water to various plant components.

The purpose of the RBCCW portion of the CCW System is to provide cooling water to various components in the Reactor Building, Primary Containment and Offgas Building. The system accomplishes this by circulating demineralized and chemically treated cooling water through these components and by transferring the heat to the plant service water system through the RBCCW heat exchangers.

The purpose of the TBCCW portion of the CCW System is to provide cooling water to various components in the Turbine Building. The system accomplishes this function by circulating demineralized and chemically treated cooling water through these components and by transferring the heat to the plant's service water system through the TBCCW heat exchangers. The TBCCW portion of the CCW does not perform an intended function and is not in scope for license renewal.

The intended functions of the CCW System within the scope of license renewal include the following:

- Provide primary containment boundary. The system includes safety-related primary containment isolation valves (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. It contains nonsafety-related water-filled lines in the Reactor Building, Primary Containment, and Auxiliary Building that provide structural support or that have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The system contains components that are environmentally qualified (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-1 identifies the CCW System component types within the scope of license renewal and subject to an AMR.

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1, UFSAR Sections 9.2.3 and 9.2.8, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.1.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the CCW System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.2 Combustible Gas Control System

2.3.3.2.1 Summary of Technical Information in the Application

The Combustible Gas Control (CGC) System includes the nitrogen supply system, containment vent and purge system, and the hydrogen recombiner system. The CGC System is a standby system designed to ensure that primary containment integrity is not threatened by the possibility of combustion of combustible gases following a LOCA. The CGC System is within the scope of license renewal. However, portions of the CGC System are not required to perform intended functions and are not included in the scope of license renewal.

LRA Section 2.3.3.2 states that the purpose of the CGC System includes inerting primary containment with nitrogen, purging containment with air to permit maintenance, controlling containment pressure, and controlling combustible gas concentrations after a LOCA.

The purpose of the nitrogen supply system is to provide a supply of gaseous nitrogen to the primary containment on both units to maintain an inert atmosphere within primary containment. Liquid nitrogen, which is stored in tanks, is vaporized and is provided to either unit in high-flow mode for inerting and in low-flow mode for normal makeup to maintain an inert atmosphere at a slight positive pressure. The nitrogen supply system is nonsafety related, does not support any intended functions, and is not in scope for license renewal.

The purpose of the containment vent and purge system is to supply nitrogen from the nitrogen supply system or air from the Reactor Building to Primary Containment and to vent displaced containment atmosphere through a purge air filter train or the SGT System before discharge to the environment. The portions of the containment vent and purge system that maintain the primary or secondary containment boundary are safety related, designed to seismic Category I requirements, and are in scope for license renewal.

The purpose of the hydrogen recombiner system is to provide mixing that prevents combustible concentrations of hydrogen from accumulating in low-flow areas within the drywell. The hydrogen recombiner system is comprised of two redundant hydrogen recombiner packages that can service either unit. During post-accident conditions, when hydrogen levels in containment are elevated, flow is established from the drywell air space through a blower that is part of the recombiner package to the suppression chamber air space. The hydrogen recombining function of the hydrogen recombiners is abandoned in place and not credited for reducing hydrogen concentration inside containment. The hydrogen recombiner system is safety-related, designed to seismic Category I requirements, and is in scope for license renewal.

The intended functions of the CGC System within the scope of license renewal include the following:

- Provide primary containment boundary. The CGC System includes piping and isolation valves that form the primary containment boundary (10 CFR 54.4(a)(1)).
- Provide secondary containment boundary. The CGC System includes piping and isolation valves in the primary containment vent and purge flow paths that form the secondary containment boundary (10 CFR 54.4(a)(1)).
- Provide emergency heat removal from primary containment and provide containment pressure control. The CGC System includes flow paths from primary containment that are used to vent primary containment for pressure control (10 CFR 54.4(a)(1)).

- Control combustible gas mixtures in the primary containment atmosphere. The CGC System is credited with establishing and maintaining an inert atmosphere within primary containment during power operation. The CGC System also includes equipment that provides mixing of the containment atmosphere to prevent combustible mixtures of hydrogen and oxygen from forming following an accident (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Some portions of nonsafety-related piping are relied on to preserve the structural support intended function of the safety-related piping used for purging, inerting, and containment isolation. Some portions of the discharge and drain piping from the hydrogen recombiners may be liquid-filled and have a potential for spatial interaction with safety-related equipment within the Reactor Building (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The CGC System includes equipment that is environmentally qualified to remain functional during post-accident conditions (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The CGC System includes primary containment isolation valves that are required to close to mitigate an SBO event (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-2 identifies the CGC System component types within the scope of license renewal and subject to an AMR.

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2; UFSAR Sections 6.2.5, 7.3.5, 9.4.10, and 9.5.9; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

One review method used by the staff is to confirm the inclusion of all components subject to an AMR by reviewing the results of the screening of components within the license renewal boundary. In RAI 2.3.3.2-1, the staff notes that it could not locate continuations of piping within the scope of license renewal during its review of the drawings and locations indicated in the table below and, therefore, could not verify acceptable scoping of SSCs.

License Renewal Boundary Drawing Number and Location	Continuation Issue
LR-LAS-M-130 Sheet 1, location A/B-8	212º and 30º continuations at the containment side of penetrations M-102 and M-95, respectively, were not provided.
LR-LAS-M-130 Sheet 2, location A/B-8	212º and 30º continuations at the containment side of penetrations M-102 and M-95, respectively, were not provided.

The NRC requested that the applicant provide sufficient information to locate the license renewal boundary. If the continuation cannot be shown on license renewal boundary drawings, the applicant must provide additional information describing the extent of the scoping boundary and must verify whether there are additional component types subject to an AMR between the continuation and the termination of the scoping boundary. If the scoping classification of a section of the piping changes over the continuation, the applicant must provide additional information to clarify the change in scoping classification.

In its response letter dated August 26, 2015, the applicant stated that the piping segments at primary containment penetrations M-102 and M-95 extend inside the primary containment air space and end at the open-ended piping.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.2-1 acceptable because the applicant provided the location of the scoping boundary and stated that there are no additional components or component types subject to AMR. Therefore, the staff's concern described in RAI 2.3.3.2-1 is resolved.

2.3.3.2.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the CGC System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.3 Compressed Air System

2.3.3.3.1 Summary of Technical Information in the Application

The Compressed Air System (CAS) includes the service air plant system and the instrument air plant system. The CAS is in scope for license renewal. However, portions of the CAS are not required to perform intended functions and are not in scope. The CAS is primarily a nonsafety-related system that is designed for continuous operation.

LRA Section 2.3.3.3 states the purpose of the normally operating CAS is to provide compressed air for station use.

The purpose of the service air subsystem is to supply compressed air for operating pneumatic equipment; air operated controls; maintenance services; and interruptible equipment, such as tank mixing air spargers.

The purpose of the instrument air system is to supply compressed air for air-operated control devices and instruments outside the drywell.

A portion of the CAS performs a safety-related function. The portion of the service air piping that penetrates primary containment and the associated primary containment isolation valves are safety-related components that are relied on to provide the primary containment boundary.

The intended functions of the CAS within the scope of license renewal include the following:

- Provide primary containment boundary. The CAS contains safety-related primary containment isolation valves and piping that penetrates the primary containment (10 CFR 54.4(a)(1)).

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The CAS includes nonsafety-related piping and components that have the potential for structural interactions with safety-related SSCs (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-3 identifies the CAS component types within the scope of license renewal and subject to an AMR.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3, UFSAR Section 9.3.1, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.3.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the CAS mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.4 Control Rod Drive System

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 states that the primary safety-related purpose of the Control Rod Drive (CRD) System is to support rapid insertion of negative reactivity into the reactor core to shut down the reactor under accident or transient conditions by simultaneously inserting all control rods. The CRD System is also used to manage core reactivity and control reactor power during normal reactor operation by inserting or withdrawing control rods at a controlled rate, one rod at a time. The CRD System also supplies makeup to the reactor vessel water level reference leg condensing chambers and a low-flow rate of cool, clean, high-pressure purge water to reactor recirculation pump seals and RWCU pumps.

The intended functions of the CRD System within the scope of license renewal include the following:

- Introduce negative reactivity to achieve or maintain a subcritical reactor condition. The hydraulic control units (HCUs) provide the motive force to the control rod drive mechanisms to rapidly insert control rods during a scram event (10 CFR 54.4(a)(1)).
- Provide primary containment boundary. The directional control valves on the HCUs provide a containment isolation function from the CRD insert and withdrawal lines (10 CFR 54.4(a)(1)).
- Sense process conditions and generate signals for reactor trip or engineered safety features actuation (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The CRD System includes nonsafety-related water-filled,

pressure-retaining piping and equipment within the Reactor Building and Auxiliary Building that have the potential for spatial and structural interaction with safety-related equipment (10 CFR 54.4(a)(2)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The CRD System includes equipment that is credited by fire safe shutdown analysis to shut down the reactor via the scram function (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The CRD System includes instrumentation and equipment that is required to be environmentally qualified (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for ATWS (10 CFR 50.62). The CRD System includes solenoid valves that receive signals from the plant alternate rod insertion system to provide an alternate means of venting the scram air header and cause insertion of control rods (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The SBO analysis credits the CRD System with successfully inserting all control rods upon receipt of scram initiation signals from the reactor protection system (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-4 identifies the CRD System component types within the scope of license renewal and subject to an AMR.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4, UFSAR Section 4.6, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.4-1, the staff notes that it could not locate seismic or equivalent anchors between the safety and nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary on the following drawings:

- LR-LAS-M-100-4 (B-2) downstream of safety-related valve 1C11-F381
- LR-LAS-M-146-4 (B-1) downstream of safety-related valve 2C11-F381
- LR-LAS-M-93-1 (B-8) upstream of safety-related valve 1B33-F017A
- LR-LAS-M-139-1 (B-8) upstream of safety-related valve 2B33-F017A
- LR-LAS-M-100-3 and LR-LAS-M-146-3 (C-4, 5, 6, and 7) upstream of safety-related valves 5, 3, 4, and 9
- LR-LAS-M-100-5 and LR-LAS-M-146-6 (E-1, B-4, C-4, E-4, F-4, and E-8) upstream of safety-related valve 7 (six places)

The NRC requested that the applicant provide additional information to locate the seismic or equivalent anchors between the safety and nonsafety interface and the end of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated August 26, 2015, the applicant provided the location of additional equivalent anchors or clarified the location of existing anchors to the end of the 10 CFR 54.4(a)(2) scoping boundary.

Based on its review, the staff finds the applicant‘s response to RAI 2.3.3.4-1 acceptable because the applicant provided the location of additional equivalent anchors or clarified the location of existing anchors. Therefore, the staff’s concern described in RAI 2.3.3.4-1 is resolved.

2.3.3.4.3 Conclusion

Based on the results of the staff’s evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the CRD System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.5 Control Room Ventilation System

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 states that the purpose of the Control Room Ventilation (CRV) System is to ensure habitability inside the control rooms and auxiliary electrical equipment rooms during all normal and abnormal station operating conditions. The CRV System ensures that the control room operators are safe against postulated releases of radioactive materials, noxious gases, smoke, and steam. In addition the environment in the control rooms and auxiliary electrical equipment rooms is maintained in order to ensure the integrity of the contained safety-related controls and equipment during all station operating conditions. The CRV license renewal system consists of the control room area ventilation plant system, the auxiliary electric equipment room ventilation plant system, the refrigeration plant system, and the breathing air plant system.

The intended functions of the CRV System within the scope of license renewal include the following:

- Provide centralized area for control and monitoring of nuclear safety-related equipment. The primary purpose of the CRV System is to maintain environmental conditions and ensure the safety and comfort of operating personnel in the control room. The system also monitors for the presence of ammonia, radioactive contamination, and smoke and provides a filtered fresh air supply as necessary in response to these conditions (10 CFR 54.4(a)(1)).
- Maintain emergency temperature limits within areas containing safety-related components. The CRV System maintains environmental conditions to ensure the operability of safety-related equipment in the control rooms and auxiliary electric equipment rooms (10 CFR 54.4(a)(1)).

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The CRV System contains nonsafety-related liquid-filled components, specifically the cooling coil drip pans, which have the potential for spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The CRV System is relied on to maintain a habitable environment and to ensure the operability of safety-related components in the control rooms and auxiliary equipment rooms during a fire safe shutdown event (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The CRV system contains components that are environmentally qualified (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The CRV system is relied on to maintain a habitable environment and to ensure the operability of safety-related components in the control rooms and auxiliary electrical equipment rooms during SBO recovery (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-5 identifies the CRV System component types within the scope of license renewal and subject to an AMR.

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5 using the evaluation methodology described in SER Section 2.3 and the UFSAR and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for any additional information. During its review, the staff evaluated the system functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the CRV System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.6 Cranes, Hoists and Refueling Equipment System

2.3.3.6.1 Summary of Technical Information in the Application

LRA Section 2.3.3.6 states the purpose of the Cranes, Hoists and Refueling Equipment System is to safely move material and equipment to support operations and maintenance activities. The Cranes, Hoists and Refueling Equipment System accomplishes this through compliance with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic

Technical Activity A-36," dated July 1980, and administrative controls so that damage from a postulated heavy load drop does not prevent safe shutdown of the reactor.

The Cranes, Hoists and Refueling Equipment System is a standby system comprised of load handling bridge cranes, jib cranes, lifting devices, monorails, and hoists provided throughout the facility and designed to support operation and maintenance activities. Also included are equipment that handles fuel and other light loads above fuel and other safety-related components in support of reactor refueling. The Cranes, Hoists and Refueling Equipment System is in scope for license renewal. Portions of the Cranes, Hoists and Refueling Equipment System are not required to perform intended functions and are not in scope.

The intended functions of the Cranes, Hoists and Refueling Equipment System within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs. The reactor building crane is safety-related and seismically qualified and is used to transport heavy loads over irradiated fuel and above or near safety-related components (10 CFR 54.4(a)(1)).
- Provide a safe means for handling safety-related components and loads above or near safety-related components. The Cranes, Hoists and Refueling Equipment System components within the scope of license renewal handle equipment or fuel above or near safety-related components or spent fuel (10 CFR 54.4(a)(2)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The nonsafety-related cranes, hoists and refueling equipment that are in scope provide a safe means for handling loads above or near safety-related components (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-6 identifies the Cranes, Hoists and Refueling Equipment System component types within the scope of license renewal and subject to an AMR.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 and UFSAR Section 9.1.4 and Appendix O using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.6.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Cranes, Hoists and Refueling Equipment System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.7 Demineralized Water Makeup System

2.3.3.7.1 Summary of Technical Information in the Application

The Demineralized Water Makeup System includes the domestic water, the makeup demineralizer, and the well water plant systems. The Demineralized Water Makeup System is in scope for license renewal. However, portions of the Demineralized Water Makeup System are not required to perform or support intended functions and are not included in the scope of license renewal.

LRA Section 2.3.3.7 states the purpose of the normally operating Demineralized Water Makeup System is to provide water from onsite wells; purify the stored well water; and provide it for various uses throughout the plant, including potable and domestic use and high-purity reactor-grade water for makeup to the clean and cycled condensate storage tanks and various plant systems.

The purpose of the well water system is to provide a source of groundwater to supply plant needs. The well water system accomplishes this by pumping water from two onsite deep wells and filtering the water for storage in the 350,000-gal well water storage tank.

The purpose of the makeup demineralizer system is to purify the water stored in the well water storage tank and to make it suitable for use for makeup to the clean and cycled condensate storage tanks. The makeup demineralizer system accomplishes this by using demineralizers and filters to purify water to meet reactor-grade water quality requirements.

The purpose of the domestic water system is to provide potable water for domestic use on site. The domestic water system accomplishes this by processing water from the well water storage tank. Water for domestic consumption is chlorinated and filtered to meet drinking water standards.

The intended function of the Demineralized Water Makeup System within the scope of license renewal includes the following:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Demineralized Water Makeup System contains nonsafety-related liquid-filled lines in the Reactor Building and Auxiliary Building, which have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-7 identifies the Demineralized Water Makeup System component types within the scope of license renewal and subject to an AMR.

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7; UFSAR Sections 1.2.3.6.4, 2.4.13.1.3, 9.2.4, and 9.2.5; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.7.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Demineralized Water Makeup System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.8 Diesel Generator and Auxiliaries System

2.3.3.8.1 Summary of Technical Information in the Application

The Diesel Generator and Auxiliaries System consists of the following plant systems: the diesel generator system, diesel oil transfer system, fire seals and fuel storage, and the technical support center diesel. The Diesel Generator and Auxiliaries System also includes the security diesel.

The Diesel Generator and Auxiliaries System uses five diesel engines to power electric generators. The system includes two diesel generators for each LSCS unit and a diesel generator that can be aligned to busses that supply power to loads on both units. One of the diesel generators for each unit has the primary purpose to supply emergency power to the HPCS pump motor. The Diesel Generator and Auxiliaries System is designed for physical separation and redundancy so that no single active failure can prevent the system from performing its safety-related function and remaining functional during and following a safe shutdown earthquake seismic event. Each diesel generator includes self-contained auxiliary support systems that include starting air, closed cooling water, engine lubricating oil, combustion air intake and exhaust, and diesel fuel oil storage and transfer.

The purpose of the diesel generator system is to provide a source of electrical power that is not dependent on offsite sources and that is capable of supplying sufficient power to those electrical loads, which are required to support the simultaneous safe shutdown of both units, coincident with a LOCA on one unit.

The purpose of the fuel oil storage, transfer, and delivery system is to provide a sufficient volume of clean, high-quality fuel to support 7 days of continuous operation following all design bases accidents. The fuel oil system also includes the fuel storage, transfer and delivery system for the two diesel-driven fire pumps that is interconnected to the HPCS diesel storage tanks. The fuel oil system for the fire pumps is nonsafety-related but supports compliance with regulations for fire protection by supporting the distribution of water used for suppression of fires.

The fuel oil system also includes the fuel storage, transfer, and delivery system for the security diesel generator and Technical Support Center diesel generator. These fuel oil systems are independent of the fuel oil systems that supply fuel to the five emergency diesel generators and the diesel-driven fire pumps.

The intended functions of the Diesel Generator and Auxiliaries System within the scope of license renewal include the following:

- Provide motive power to safety-related components. The Diesel Generator and Auxiliaries System is required to power safety-related equipment in the event that normal offsite power sources are not available (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Diesel Generator and Auxiliaries System includes nonsafety-related fluid-filled lines in the diesel rooms that have the potential for spatial interactions with safety-related SSCs. The starting air system includes nonsafety-related piping that is in scope to provide a seismic anchor credited for structural support of safety-related piping (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The Diesel Generator and Auxiliaries System provides an alternate power source required to cope with an SBO event to support safe shutdown and decay heat removal for the blacked out unit for the required coping duration (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The Diesel Generator and Auxiliaries System provides power to safe shutdown equipment in the event of a loss of offsite power coincident with the postulated fire for several analyzed fire safe shutdown methods. The Diesel Generator and Auxiliaries System also provides the fuel oil supply to the diesel-driven fire water pumps that support the distribution of water used for fire suppression (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The Diesel Generator and Auxiliaries System includes safety-related components located within areas of the plant that may have harsh environments and, therefore, have environmental qualifications (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-8 identifies the Diesel Generator and Auxiliaries System component types within the scope of license renewal and subject to an AMR.

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8; UFSAR Sections 7.3.6, 8.3.1, and 9.5.4 through 9.5.8; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.8.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Diesel Generator and Auxiliaries System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.9 Drywell Pneumatic System

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 states the purpose of the Drywell Pneumatic System (DPS) is to provide a supply of gas for operation of pneumatic devices and for purging of the Traversing Incore Probe (TIP) indexing mechanisms located inside the primary containment. The DPS accomplishes this by drawing gas from inside the primary containment and processing it through filters, compressors, coolers, separators, dryers, and receivers before distributing the gas to users inside the primary containment. The DPS includes individual safety-related accumulators of sufficient capacity to provide for the operation of the MSIVs, main steam safety/relief valves, and ADS valves in the event of a loss of the normal nonsafety-related gas supply. The DPS also includes a safety-related backup compressed gas system for the ADS accumulators consisting of two compressed nitrogen bottle banks and an emergency pressurization station that provide a long-term pneumatic supply to the ADS valves to support post-accident reactor decay heat removal.

The intended functions of the DPS within the scope of license renewal include the following:

- Provide primary containment boundary. The DPS includes safety-related containment isolation valves (10 CFR 54.4(a)(1)).
- Provide motive power to safety-related components. The DPS provides a supply of gas for operation of the MSIVs, main steam safety/relief valves, and ADS valves following a DBA (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The DPS contains nonsafety-related water-filled lines in the Reactor Building that have potential spatial interactions with safety-related SSCs. The DPS also contains nonsafety-related gas-filled lines relied on to preserve the structural support intended function of the system (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The function of providing gas for ADS valve operation is credited for fire safe shutdown (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The DPS contains components that are environmentally qualified (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The function of providing gas for ADS valve operation is credited for SBO coping (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-9 identifies the DPS component types within the scope of license renewal and subject to an AMR.

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9 and UFSAR Section 9.3.1 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.9.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the DPS mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.10 Electrical Penetration Pressurization System

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 states that the purpose of the Electrical Penetration Pressurization (EPP) System is to provide a means to manually supply nitrogen to electrical penetration assemblies for Unit 2. The electrical penetration assemblies provide continuity of electric circuits through the containment building wall while maintaining containment integrity. The assemblies are pressurized internally with nitrogen to minimize moisture intrusion and condensation. This ensures that the connected electrical equipment performs as required and ensures containment leak-tightness.

The intended function of the EPP System within the scope of license renewal includes the following:

- Provide primary containment boundary. The EPP System components connect directly to the LSCS, Unit 2, electrical penetration assemblies and have the potential for structural interaction (10 CFR 54.4(a)(1)).

LRA Table 2.3.3-10 identifies the EPP System component types within the scope of license renewal and subject to an AMR.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10; UFSAR Sections 6.2.6.2 and 3.8.1.1 and Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.10.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the EPP System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.11 Essential Cooling Water System

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 states the purpose of the Essential Cooling Water (ECW) System is to circulate lake water from the ultimate heat sink (UHS) to the RHR System heat exchangers, diesel generator coolers, core standby cooling system (CSCS) area coolers, LPCS System pump motor cooling coils, and RHR pump seal coolers by circulating cooling water from the UHS to the component coolers and returning the heated water to the UHS. The ECW System is a standby system.

Another function of the ECW System includes providing a source of emergency makeup water for fuel pool cooling and containment flooding water for post-accident recovery by providing water from the UHS to the spent fuel pool emergency makeup pumps. Flooding of the containment is accomplished by providing water from the UHS to the containment.

The intended functions of the ECW System within the scope of license renewal include the following:

- Remove residual heat from the reactor coolant system. The ECW System provides cooling to equipment that removes decay heat from the reactor during normal operation and accident conditions (10 CFR 54.4(a)(1)).
- Provide heat removal from safety-related heat exchangers. The ECW System removes heat from the RHR heat exchangers and ECCS pump seal and motor coolers during normal operation and accident conditions (10 CFR 54.4(a)(1)).
- Provide emergency heat removal from primary containment and provide containment pressure control. The ECW System removes heat from the RHR heat exchangers during transient and accident conditions. The ECW System provides containment flooding water for post-accident recovery (10 CFR 54.4(a)(1)).
- Maintain emergency temperature limits within areas containing safety-related components. The ECW System removes heat from secondary containment equipment compartments that house ECCS and ECW components (10 CFR 54.4(a)(1)).
- Ensure adequate cooling in the spent fuel pool to maintain stored fuel within acceptable temperature limits. The ECW System provides a source of emergency makeup water for fuel pool cooling (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The ECW System contains nonsafety-related fluid-filled lines in the Auxiliary Building, which provide structural support or have potential spatial interactions with safety-related SSC (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The ECW System provides cooling to equipment that is credited with maintaining reactor level and cooling the reactor and containment for fire safe shutdown (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The ECW System includes components that are environmentally qualified (10 CFR 54.4(a)(3)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The ECW System provides cooling for equipment that is credited with maintaining reactor water injection and for containment heat removal for SBO coping (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-11 identifies the ECW System component types within the scope of license renewal and subject to an AMR.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11; UFSAR Sections 2.5.5.2.5, 9.2.1, and 9.2.6; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.11-1, the staff notes that drawings LR-LAS-M-87-3 (E-6) and LR-LAS-M-134-3 (D-6) show 10 CFR 54.4(a)(1) piping (1DG15D 2 and 2DG15D 2) whose scope changes to 10 CFR 54.4(a)(2) without a change in piping classification. The NRC requested that the applicant provide sufficient information to clarify the change in scoping classification.

In its response letter dated August 26, 2015, the applicant stated that piping components downstream of the safety-related valves 1DG039 and 2DG039 are not ASME Code components, are not safety related, and do not have a 10 CFR 54.4(a)(1) intended function. These piping components have 10 CFR 54.4(a)(2) intended functions to provide structural support of attached piping with 10 CFR 54.4(a)(1) intended functions and to provide a leakage boundary for nearby components that have 10 CFR 54.4(a)(1) intended functions. The piping upstream of these valves are ASME Code Class 3 components and tested to ASME Code Section XI requirements.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.2-2 acceptable because the applicant clarified the reason for the change in scope from 10 CFR 54.4(a)(1) to 10 CFR 54.4(a)(2) for piping and components downstream of valves 1DG039 and 2DG039. Therefore, the staff's concern described in RAI 2.3.3.11-1 is resolved.

2.3.3.11.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the ECW System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.12 Fire Protection System

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 states that the purpose of the Fire Protection System is to prevent fires from starting, quickly detect any fires, quickly suppress fires in hazard areas, prevent the spread of a fire by use of barriers, and provide firefighting capability for manual fire extinguishment.

The Fire Protection System is common to both Units 1 and 2 and is designed to provide detection and suppression of a fire at the plant. The Fire Protection System is nonsafety-related, but it provides detection and suppression equipment and design features that support the safe shutdown of the plant. The Fire Protection System includes water, carbon dioxide (CO_2), and halon fire suppression systems. It also includes active and passive features, such as fire doors, dampers, penetration seals, fire wraps, fire barrier walls and slabs, and flammable fluid retention curbs and walls to prevent the spread of a fire.

The fire water system provides cooling lake water to the plant fire hydrants, the water sprinkler systems, spray systems, deluge systems, and the hose valve stations. The system is normally kept pressurized by two fire protection jockey pumps. If a system demand occurs, the motor driven intermediate fire pump is automatically activated. If the system demand exceeds the capacity of this pump, the pressure decreases in the fire water system, thereby automatically starting a diesel-driven fire pump. If demand is in excess of the capability of a single diesel fire pump or if there is a pump failure, the second diesel driven fire pump is started automatically. If these pumps are unavailable, the plant Nonessential Cooling Water System service water system pumps may be used as a backup to provide the system demand. The fire pumps take suction from the service water tunnel in the Lake Screen House and supply water to the yard ring header. The fire hydrant system is supplied by separate header connections to each of the two diesel driven fire pumps. The yard loop is sectionalized, thus permitting independence of each unit if desired. Fire protection water is distributed to the hydrants, hose stations, and water suppression systems in the plant from the yard fire main loop, which encircles the power block.

Multiple headers from the outside fire loop are brought into the building complex to feed the standpipes, hose stations and sprinkler, spray and deluge water systems. Wet standpipes for hose stations are located throughout the plant to allow use of fire hoses to support local fire brigade activity. Wet pipe sprinkler operation is initiated automatically when ambient temperature exceeds the melting point of the fusible links of the sealed sprinklers, causing the spray heads to open. Preaction sprinkler system operation is actuated by area fire detectors that open deluge valves supplying fusible element sprinkler heads, which melt when local ambient temperatures rise due to a fire. System actuation transmits alarm signals to the main control room.

An automatic CO_2 flooding extended discharge system is provided for each of the five diesel generator rooms. Each system is activated by a fixed temperature rise detector system and may also be manually activated. The CO_2 systems consist of a common refrigerated storage unit and associated piping, headers, and valves to the five diesel generator rooms. Hose reels are also provided for manually fighting fires. Audible and visual predischarge alarms warn that the CO_2 flooding system is about to actuate so that personnel may leave the area. Actuation of the CO_2 flooding system automatically shuts down the local fans and closes the local dampers in the ventilation system. The CO_2 storage unit also provides CO_2 for fire suppression in the main generator Alterrex housings and purge gas for the main generators.

Halon fire suppression systems are used in the plant computer room in the south service building, in quality assurance archives in the north service building, and in the records storage building. Audible and visual predischarge alarms warn that the halon system is about to actuate so that personnel may leave the area. Actuation of the halon system automatically shuts down the local fans and closes the local dampers in the ventilation system.

The Fire Protection System includes features to isolate safety-related systems from unacceptable fire hazards. Barriers, such as walls, floors, ceilings, fire doors, fire dampers, cable and piping penetration seals, and ventilation seals, are used to isolate the safety-related systems. In addition, curbs and walls are provided to minimize the spread of flammable fluids in the event of a spill.

The Fire Protection System license renewal boundary begins in the Lake Screen House, where the fire pumps take suction from the service water tunnel and supply water to the fire main ring header and yard fire hydrants, and extends into the building fire distribution piping for hose station standpipes, water spray subsystems, water sprinkler subsystems, and water deluge subsystems throughout the plant. Included is the interface with the Nonessential Cooling Water System that provides a source of fire water in the event the fire water pumps are not available. The CO_2 fire suppression subsystem begins at the CO_2 storage unit and extends via distribution piping to each of the five diesel generator rooms and hose reels.

The intended functions of the Fire Protection System within the scope of license renewal include the following:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Fire Protection System includes nonsafety-related SSCs with the potential for spatial and structural interaction with safety-related equipment in the Reactor Buildings, Auxiliary Building, Turbine Buildings, Diesel Generator Buildings, and Offgas Building (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The Fire Protection System provides the capability to control postulated fires in plant areas to maintain safe shutdown ability (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-12 identifies the Fire Protection System component types that are within the scope of license renewal and subject to an AMR.

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12 and the relevant LRA drawings using the evaluation methodology described in the SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff also reviewed UFSAR Section 9.5.1, "Fire Protection System," and the FPR, which describe the fire protection program at LSCS and explain how it complies with the requirements of 10 CFR 50.48, "Fire Protection," and the guidelines of Branch Technical Position (BTP) Auxiliary Systems Branch (ASB) 9.5-1.

The staff also reviewed the following fire protection documents cited in the CLB listed in the LSCS, Units 1 and 2, Operating License Conditions 2.C(25) and 2.C(15), respectively:

- NUREG-0519, "Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2," dated March 1981
- NUREG-0519, Supplement 2, "Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2," dated February 1982
- NUREG-0519, Supplement 3, "Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2," dated April 1982

- NUREG-0519, Supplement 5, “Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2,” dated August 1983
- NUREG-0519, Supplement 7, “Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2,” dated December 1983
- NUREG-0519, Supplement 8, “Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2,” dated March 1984
- LaSalle Unit 1 License Amendment 1, dated June 18, 1982
- LaSalle Unit 1 License Amendment 18, dated August 8, 1984
- LaSalle Unit 1 License Amendment 23, dated May 22, 1985
- LaSalle Unit 1 License Amendment 44, dated June 20, 1986
- LaSalle Unit 1 License Amendment 127, dated June 10, 1998
- LaSalle Unit 2 License Amendment 11, dated May 22, 1985
- LaSalle Unit 2 License Amendment 14, dated October 2, 1985
- LaSalle Unit 2 License Amendment 112, dated June 10, 1998
- “NRC Evaluation of the Consequences of Postulated Failures of 1 Hour Fire Rated Darmatt KM-1 Fire Barrier under Seismic Loading at LaSalle County Station, Units 1 and 2,” dated March 29, 1996

During its review, the staff evaluated the system functions described in the LRA and UFSAR Section 9.5.1 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 or 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 its review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

In RAI 2.3.3.12-1 of its letter dated June 8, 2015, the staff noted that LRA boundary drawing LR-LAS-M-78, Sheet 1, shows flame arrestors at location E4 and E5 and CO_2 fire suppression system components at locations C4 and C5 as out of scope (i.e., not colored in green). The staff requested that the applicant verify whether the above fire protection systems and components are in 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 a letter dated July 1, 2015, the applicant responded to RAI 2.3.3.12-1 by stating the following:

> The flame arrestors, shown in the center of boundary drawing LR-LAS-M-78, Sheet 1 (E4 and E5), are part of the plant hydrogen system supporting the main generator. The flame arrestors are provided in the plant hydrogen system vent to the turbine building roof. The plant hydrogen system is part of the license renewal Main Generator and Auxiliaries System. The Main Generator and

> Auxiliaries System and its components do not perform license renewal intended functions and are not included in the scope of license renewal. The flame arrestors are not in scope for 10 CFR 54.4(a)(3) license renewal since they are not required to meet the regulations for fire protection. The flame arrestors in the plant hydrogen system vent do not perform a license renewal intended function. Therefore, the flame arrestors are not within the scope of license renewal and are not subject to an AMR.
>
> The carbon dioxide components associated with carbon dioxide vaporizer shown on boundary drawing LR-LAS-M-78, Sheet 1 (C4 and C5) support the main turbine generators with a supply of carbon dioxide (CO_2) in a high flow gaseous state. The purge gas portion of the plant carbon dioxide system, which is part of the license renewal Fire Protection System, is not in scope. The CO_2 is used to purge the hydrogen from the generator prior to filling with air in support of performing maintenance. Additionally, the CO_2 is used to purge the air prior to filling with hydrogen when returning the generator to service. The CO_2 purges prevent a combustible mixture of hydrogen and oxygen at the start and completion of routine maintenance. These CO_2 components are not in scope for 10 CFR 54.4(a)(3) license renewal since they are not required to meet the regulations for fire protection. CO_2 purges for hydrogen and for air in support of maintenance are not a license renewal intended function. Therefore, the CO_2 components in support of the turbine generator hydrogen subsystem are not within the scope of license renewal and are not subject to AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-1 acceptable. The applicant clarified that the flame arrestors in drawing LR-LAS-M-78, Sheet 1, locations E4 and E5, are part of the plant hydrogen venting system for the main turbine generator and auxiliaries system and that they perform no license renewal intended function for 10 CFR 54.4(a)(3) and are not required for compliance with 10 CFR 50.48. Therefore, they are not within the scope of license renewal and subject to an AMR. The flame arrestors in question were correctly excluded from the scope of license renewal and are not subject to an AMR because they are not fire protection SSCs. Therefore, the staff's concern described in RAI 2.3.3.12-1 is resolved. The staff noted that flame arrestors in drawing LR-LAS-M-85, Sheet 1, locations E5 and E7 (diesel generator day tanks and diesel fuel storage tanks), are highlighted in green. These flame arrestors are included in LRA scoping Table 2.3.3-8 with AMR results in LRA Table 3.3.2-8.

Based on its review, the staff finds the applicant response to RAI 2.3.3.12-1 acceptable because the applicant clarified that the CO_2 system components at locations C4 and C5 in drawing LR-LAS-M-78, Sheet 1, support the main turbine generators and are used to purge the hydrogen from the generator before filling with air in support of performing maintenance and that they have no license renewal intended function for 10 CFR 54.4(a)(3) and are not required for compliance with 10 CFR 50.48. Therefore, they are not within the scope of license renewal and subject to an AMR. The CO_2 system components at locations C4 and C5 in drawing LR-LAS-M-78, Sheet 1, in question were correctly excluded from the scope of license renewal and are not subject to an AMR because these are not fire protection SSCs, although the CO_2 system components in question share a common CO_2 supply tank with the plant CO_2 fire suppression system. Therefore, the staff's concern described in RAI 2.3.3.12-1 is resolved.

In RAI 2.3.3.12-2 of its letter dated June 8, 2015, the staff stated that the LRA Tables 2.3.3-12 and 3.3.2-12 do not include the following fire protection components:

- standpipe risers
- fire suppression system filter housings
- smoke and heat vent housings
- fire barrier coatings and wraps

The staff requested that the applicant verify whether the fire protection components listed above are in 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 a letter dated July 1, 2015, the applicant responded to RAI 2.3.3.12-2 by stating the following:

> Standpipe Risers – Standpipe risers are within the scope of license renewal and are subject to an AMR. Standpipe risers are included in LRA Table 3.3.2–12 as carbon steel piping, piping components, and piping elements with a pressure boundary intended function.
>
> Fire Suppression System Filter Housings – Fire suppression filter housings are within the scope of license renewal and are subject to an AMR. They are included in LRA Table 3.3.2-12 as carbon steel piping, piping components, and piping elements with a pressure boundary intended function.
>
> Smoke and Heat Vent Housings – Smoke and heat vent housings are located in the LSCS Turbine Building roof. These smoke and heat vent housings are not relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection, specifically considering the regulations applicable to LSCS's current licensing basis: 10 CFR 50.48, Branch Technical Position (BTP) ASB 9.5-1, Appendix R to Part 50 – Fire Protection Program for Nuclear Power Facilities, and the associated Safety Evaluation Report for LSCS Fire Protection. The BTP discusses smoke and heat vents in support of manual fire fighting for some areas, such as cable spreading rooms, diesel fuel oil storage areas, and switchgear rooms. It does not discuss the Turbine Building smoke and heat vents in this regard. The Turbine Building roof smoke and heat vent housings are discussed in the UFSAR and Fire Protection Report. There is no connection between the BTP manual fire fighting support statement and the Turbine Building roof vent housing discussions. The UFSAR and Fire Protection report information is provided for completeness of the area description and does not imply that the vent housings are required or credited for implementation of regulatory requirements. The smoke and heat vent housings are not safety-related nor relied upon to remain functional during design basis events, and the failure of these nonsafety-related components would not prevent the accomplishment of safety-related functions. The smoke and heat vent housings are not relied upon to demonstrate compliance with the Commission's regulations for Environmental Qualification, Anticipated Transient Without Scram, or Station Blackout. Therefore, the smoke and heat vent housings do not perform a license renewal intended function. They are not in scope for license renewal and therefore are not subject to AMR.

> Fire Barrier Coatings and Wraps – Fire barrier coatings and wraps are within the scope of license renewal and are subject to an AMR. They are included in LRA Table 3.3.2–12 as aluminum silicate, ceramic fiber, and pyrocrete Fire Barriers (For Steel Components) with a fire barrier intended function.

In reviewing the applicant's response to the RAI, the staff finds that the applicant has addressed and resolved each item in the RAI, as discussed in the following paragraphs.

Although the description of the "standpipe raisers" and "fire suppression system filter housings" items in LRA Table 2.3.3-12 does not list these components specifically, the applicant stated that it considers these items to be included with the "carbon steel piping, piping components, and piping elements" in LRA AMR Table 3.3.2-12 with a pressure boundary intended function.

The applicant stated that the Turbine Building smoke and heat vents do not have fire protection intended functions required for compliance with 10 CFR 50.48. Additionally, the applicant stated that the Turbine Building smoke and heat vents are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection, specifically considering the regulations applicable to the LSCS's CLB. The licensee concluded that the smoke and heat vent housings are not within the scope of license renewal and are not subject to an AMR.

The staff finds the applicant's response contrary to the UFSAR and Revision 6 to the FPR, which include the original LSCS fire protection program as the CLB. FPR Section H.3.5.3, "Turbine Operating Floor and Heater Bay – Fire Zone 5A3," subsection entitled, "Description," states, in part:

> Fusible link type heat and smoke vents are provided on the turbine building roof. The criteria for sizing these vents is a vent ratio of one to one hundred for the combined floor area of the main turbine floor and the heater bay. Motorized outside doors are provided for intake air for heat and smoke venting.

FPR Section H.3.5.3, subsection entitled, "Safety-Related Equipment," states that "[t]his zone contains safety related HVAC monitoring instrumentation."

Additionally, FPR Section H.3.5.3, subsection entitled, "Design-Basis Fire," states:

> The design-basis fire would be contained within the turbine building. It is possible for oil, in the unlikely event of a line rupture, to leak down to the zone below; however, that zone is completely protected by automatic sprinklers. The automatic sprinklers are designed to extinguish an oil fire and the automatic smoke and heat vents would prevent heat from building up and causing any flashover.

Fire Zone 5A3 contains safety-related heating, ventilation, and air conditioning (HVAC) monitoring instrumentation and equipment, and the fire protection system consists of the automatic sprinkler system and automatic smoke and heat vents noted above. According to the LSCS's FPR, following an oil fire in Fire Zone 5A3, automatic smoke and heat vents would prevent heat from building up and causing any flashover. Based on the LSCS CLB, Turbine Building smoke and heat vents were credited to meet the guidance of BTP ASB 9.5-1. The Turbine Building automatic smoke and heat vent housings should not be excluded from the scope of license renewal on the basis that they are not required to function during a fire or that they are not required for compliance to 10 CFR 50.48, without factoring in the CLB. Further, the staff stated that the Turbine Building smoke and heat vent housings in question must be managed during the period of extended operation to comply with 10 CFR 50.48 (in accordance with the CLB) as stated in 10 CFR 54.4(a)(3).

In RAI 2.3.3.12-2a of its letter dated August 27, 2015, the staff requested that the applicant provide information to demonstrate 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).

In a letter dated September 17, 2015, the applicant responded to RAI 2.3.3.12-2a by stating the following:

> The Turbine Building smoke and heat vents are added to the scope of license renewal. They are active components, and are not subject to aging management review. The Turbine Building smoke and heat vent housings are passive components, and are added to the scope of the Structures Monitoring (B.2.1.34) aging management program to specifically identify these components. The program is enhanced to include the smoke and vent housings in the program scope. These components will be inspected for loss of material.
>
> LRA Sections 2.3.3.12 and 2.4.13, LRA Table 2.4-13, LRA Table 3.5.2-13, LRA Appendix A, Section A.2.1.34, and LRA Appendix B, Section B.2.1.34 are revised as shown in Enclosure B to include aging management of these components. LRA Table A.5, Commitment 34 is revised as shown in Enclosure C to reflect this change.

Based on its review, the staff finds the applicant response to RAI 2.3.3.12-2a acceptable because the applicant clarified that the Turbine Building heat vents are within the scope of license renewal and are subject to an AMR (only housings). The staff confirmed that the Turbine Building heat vent housings are included in LRA Table 2.4-13 as subject to an AMR in LRA Table 3.5.2-13. The staff's concern described in RAI 2.3.3.12-2a is resolved.

The fire barriers coatings and wraps are included in LRA AMR Table 3.3.2-12 under the component type aluminum silicate, ceramic fiber, and pyrocrete fire barriers for steel components with a fire barrier intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-2 acceptable because the applicant provided clarification that the fire protection system and components listed above are within the scope of license renewal and are subject to an AMR as required by 10 CFR 54.4(a) and 54.21(a)(1), respectively. The staff's concern described in RAI 2.3.3.12-2 is resolved.

In RAI 2.3.3.12-3 of its letter dated June 8, 2015, the staff stated that LRA Section 2.3.3.16 and Table 2.3.3-16, "Components Subject to Aging Management Review," of the LRA does not include fire water and oil floor drains as a component type subject to an AMR. The staff requested that the applicant verify whether the fire water floor drains and Diesel Generator Building oil floor drains are subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are not subject to an AMR, the staff requests that the applicant provide justification for the exclusion.

In a letter dated July 1, 2015, the applicant responded to RAI 2.3.3.12-3 by stating the following:

> Fire water floor drains in the Auxiliary Building, Diesel Generator Building, and Turbine Building, and oil floor drains in the Diesel Generator Building are included in the scope of license renewal and are subject to an AMR. The drains are included in LRA Table 3.3.2–16 as carbon steel piping, piping components, and piping elements with a pressure boundary intended function. The internal environment is waste water which is defined, in part, in NUREG–1801 Table IX.D as water collected in floor drains that may contain contaminants including oil.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-3 acceptable because the applicant clarified that the water floor drains in the Auxiliary Building, Diesel Generator Building, and Turbine Building and that the oil floor drains in the Diesel Generator Building are included in the scope of license renewal and are subject to an AMR under item carbon steel piping, piping components, and piping elements in LRA AMR Table 3.3.2-16. The staff confirmed that the water and oil floor drains are included in LRA Table 3.3.2-16, "Plant Drainage System," under the component type "carbon steel piping, piping components, and piping elements." Note that the water and oil floor drains are included in LRA Table 3.3.2-16, as "carbon steel piping, piping components, and piping elements," with an indoor waste water environment. The GALL Report defines the term "waste water" as "[r]adioactive, potentially radioactive, or non-radioactive waters that are collected from equipment and floor drains. Waste water may contain contaminants, including oil and boric acid, depending on location, as well as originally treated water that is not monitored by a chemistry program." Therefore, the staff's concern described in RAI 2.3.3.12-3 is resolved.

LRA Section 2.3.3.12 includes physical plant design features that consist of fire barrier walls and slabs, fire barrier penetration seals, fire doors and dampers, fire wraps, and flammable fluid retention curbs and walls in the system evaluation boundary. This includes fire dampers in the Reactor Buildings, Turbine Buildings, Auxiliary Building, Lake Screen House, Radwaste Building, and Diesel Generator Buildings. Further, LRA Section 2.3.3.12 states that fire damper housings are subject to an AMR and that the fire barrier function of all fire damper housings is evaluated with the Fire Protection System for license renewal AMR. The pressure boundary function of the fire damper housings, if applicable, is evaluated with the appropriate ventilation system. Furthermore, LRA Section 2.3.3.12 states that the dampers are active components and are not subject to an AMR. The Fire Protection System includes fire-rated doors in the Reactor Buildings, Turbine Buildings, Auxiliary Building, and Diesel Generator Buildings. Air supervised pre-action sprinkler systems are provided with individual air compressors to maintain air pressure.

LRA Section 2.3.3.12 states that the diesel engine for the diesel driven fire pumps contains active components and is, therefore, not subject to an AMR. The staff confirmed that the diesel engine for diesel-driven fire pumps does not meet the AMR criteria of 10 CFR 54.21(a)(1)(i). SRP-LR Table 2.1-5, "Typical Structures, Components, and Commodity Groups, and 10 CFR 54.21(a)(1)(i) Determinations for Integrated Plant Assessment," provides a list of typical SCs and identifies whether they meet 10 CFR 54.21(a)(1)(i). Table 2.1-5 indicates that fire pump diesel engines are not subject to an AMR.

LRA Section 2.3.3.12 indicates that the fuel oil supply piping and diesel fuel fire pump day tank for the fire pump diesel engines are evaluated in LRA Section 2.3.3.8, "Diesel Generator and Auxiliaries System." The staff confirmed that the diesel fuel fire pump day tank for the fire pump diesel engines is included in LRA Table 2.3.3-8.

LRA Section 2.3.3.12 indicates that LRA Section 2.3.3.14, “Nonessential Cooling Water System,” included traveling water screens within the scope of license renewal and subject to an AMR. The staff confirmed that the traveling water screens are included in LRA Table 2.3.3-14 as subject to an AMR in LRA Section 3.3.2-19.

LRA Section 2.3.3.12 indicates that the halon fire suppression system that services the computer room in the south service building and the records storage areas in the north service building and records storage building is not subject to an AMR. Further, LRA Section 2.3.3.12 states that these areas do not contain any safety-related equipment and that the halon systems do not perform or support an intended function in accordance with 10 CFR 54.4(a)(3). The staff confirmed that the halon fire suppression system and components do not meet the license renewal intended function in accordance with 10 CFR 54.4(a)(3). Further, LRA Section 2.3.3.15 indicates that CO_2 supply piping to the main generator Alterrex housings and purge gas for the main generators provides for asset protection and does not perform or support an intended function in accordance with 10 CFR 54.4(a)(3); therefore, it need not be included in the scope of license renewal.

LRA Section 2.4.5, “Lake Screen House,” includes the service water tunnel structure where fire pumps take suction and supply water to the yard ring header. LRA Section 2.4.5 states that the Lake Screen House meets the scoping criteria of 10 CFR 54.4, “Scope.” The purpose of the Lake Screen House is to provide structural support, shelter, protection, and access to submerged CSCS pond water for Seismic Category I safety-related concrete structural components and mechanical components under postulated environmental and DBA loading conditions. The Lake Screen House also provides a water-retaining boundary for the Cooling Lake. The Lake Screen House also provides structural support, shelter, protection, and access to Cooling Lake water for non-Seismic Category I plant equipment and components, including fire protection pumps and associated piping, valves, and related equipment. The Lake Screen House is within the scope of license renewal and is subject to an AMR. The staff confirmed that the Lake Screen House structural components subject to an AMR are included in LRA Table 2.4-5 with AMR results in LRA Table 3.5.2-5.

2.3.3.12.3 Conclusion

Based on the results of the staff’s evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR Section 9.5.1, “Fire Protection System,” and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.13 Fuel Pool Cooling and Storage System

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 states that the purpose of the Fuel Pool Cooling and Storage System is to maintain the fuel stored in the spent fuel pools and new fuel storage vault in a safe subcritical configuration by removing decay heat from spent fuel assemblies stored in the spent fuel pools, maintaining fuel pool water temperature and level within required limits, purifying water in the spent fuel pools, and minimizing contamination and radiation exposure from fission and corrosion product buildup in the spent fuel pool water. The Fuel Pool Cooling and Storage

System also supports filling and draining of the reactor wells and dryer/separator pits in support of refueling operations.

The Fuel Pool Cooling and Storage System is a normally operating system designed to provide an environment to safely and temporarily store new and used nuclear fuel and consumable reactor internal components including control rods and nuclear instrumentation. The Fuel Pool Cooling and Storage System includes the spent fuel storage racks, defective fuel storage racks, control rod blade storage racks within the spent fuel storage pools, and new fuel storage racks. The Fuel Pool Cooling and Storage System also includes skimmer surge tanks; heat exchangers; pumps; water purifying loops; discharge diffusers within the fuel pools; and associated valves, piping components, and instrumentation. The Fuel Pool Cooling and Storage System is in scope for license renewal. However, portions of the system are not required to perform intended functions and are not in scope.

The intended functions of the Fuel Pool Cooling and Storage System within the scope of license renewal include the following:

- Ensure adequate cooling in the spent fuel pool to maintain stored fuel within acceptable temperature limits. The Fuel Pool Cooling and Storage System includes safety-related equipment to circulate and cool the fuel pool water inventory and maintain adequate water inventory (10 CFR 54.4(a)(1)).
- Prevent criticality of fuel assemblies stored in the spent fuel pool. The spent fuel storage racks maintain new and spent nuclear fuel in a subcritical configuration, with at least a 5-percent subcriticality margin (10 CFR 54.4(a)(1)).
- Provide protection for safe storage of new and spent fuel. The spent fuel storage racks provide physical support, shelter, and protection for new and spent nuclear fuel (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The system includes nonsafety-related piping that has the potential to spatially and structurally interact with safety-related components located in the Reactor Building and Auxiliary Building (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-13 identifies the Fuel Pool Cooling and Storage System component types within the scope of license renewal and subject to an AMR.

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13, UFSAR Sections 7.7.12 and 9.1, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.13-1, the staff notes that Unit 1 drawing LR-LAS-M-98-1 shows 10 CFR 54.4(a)(1) piping whose scope changed to 10 CFR 54.4(a)(2) without a change in piping classification at the following locations in the table below:

LR-LAS-M-98, Sheet-1, Location	Piping ID
Location C-2	1FC87A upstream of valve 1FC130

LR-LAS-M-98, Sheet-1, Location	Piping ID
Location C-5	1FC19AA downstream of valve 1FC118
Location C-8	1FC110A upstream of valve 1FC141
Location B-8	1FC01DA downstream of valve 1FC139A
Location A-8	1FC01DB downstream of valve 1FC139B

Similarly for Unit 2, drawing LR-LAS-M-144, Sheet-1, shows 10 CFR 54.4(a)(1) piping whose scope changed to 10 CFR 54.4(a)(2) without a change in piping classification at the following locations in the table below:

LR-LAS-M-144, Sheet-1, Location	Piping ID
Location C-1	2FC11DA upstream of valve 2FC141
Location B-1	2FC01DA downstream of valve 2FC139A
Location B-1	2FC01DB downstream of valve 2FC139B
Location C-4	2FC19AA downstream of valve 2FC118
Location C-7	2FC87A upstream of valve 2FC130

The NRC requested that the applicant provide sufficient information to clarify the change in scoping classification.

In its response letter dated August 26, 2015, the applicant stated that these piping sections are properly scoped as being in scope for 10 CFR 54.4(a)(2) intended functions to provide structural support for attached piping and to provide a leakage boundary for nearby components that have 10 CFR 54.4(a)(1) intended functions. These piping sections are classified within the LSCS current design basis as nonsafety-related and they do not have 10 CFR 54.4(a)(1) intended functions.

The applicant referred to the LSCS System Safety Boundary Document for the Fuel Pool Cooling Filter and Demineralizer (FC) System, which states that the normal fuel pool cooling loops are not safety related, are designed as a non-seismic and electrical non-1E system, but are designed and procured to ASME Code Section III standards. UFSAR Table 3.2-1, Sheet 8, Section XX, "Fuel Pool Cooling and Cleanup System," and associated notes 4a, 4b, 5, and 18 provide design bases information that is consistent with the information discussed in the System Safety Boundary Document for the Fuel Pool Cooling Filter and Demineralizer (FC) System.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-1 acceptable because the applicant provided clarification for the scoping changes. The design and licensing basis information cited by the applicant provides the basis for the scoping classification changes from 10 CFR 54.4(a)(1) to 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.3.3.13-1 is resolved.

The staff noted that Unit 1 drawing LR-LAS-M-98-1 (C-7) shows a 10 CFR 54.4(a)(2) line 1FC11DC 10 downstream of a 10 CFR 54.4(a)(1) valve 1FC086 whose scope changed to 10 CFR 54.4(a)(2), whereas the piping classification changed to "Class C," indicating safety-related piping.

Unit 2 drawing LR-LAS-M-144-1 (C-2) shows a 10 CFR 54.4(a)(2) line 2FC11DC 10 downstream of a 10 CFR 54.4(a)(1) valve 2FC086 whose scope changed to 10 CFR 54.4(a)(2), whereas the piping classification changed to "Class C," indicating safety-related piping.

The applicant was requested, through RAI 2.3.3.13-2, to provide sufficient information to clarify the change in scoping classifications.

In its response letter dated August 26, 2015, the applicant stated that these piping sections are properly scoped as being in scope for a 10 CFR 54.4(a)(2) intended functions to provide structural support for attached piping and to provide a leakage boundary for nearby components that have 10 CFR 54.4(a)(1) intended functions. These piping sections are classified within the LSCS current design basis as nonsafety-related and do not have 10 CFR 54.4(a)(1) intended functions.

The applicant referred to the LSCS System Safety Boundary Document for the Fuel Pool Cooling Filter and Demineralizer (FC) System, which states that the normal fuel pool cooling loops are not safety-related, are designed as a nonseismic and electrical non-1E system, but are designed and procured to ASME Code Section III standards. These classifications for this piping are consistent with UFSAR Table 3.2-1, Sheet 8, Section XX, and associated notes 4a, 4b, 5, and 18.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-2 acceptable because the applicant clarified the scoping changes. The design and licensing basis information cited by the applicant provides the basis for the license renewal scoping classification changes from 10 CFR 54.4(a)(1) to 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.3.3.13-2 is resolved.

2.3.3.13.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI responses, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Fuel Pool Cooling and Storage System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.14 Nonessential Cooling Water System

2.3.3.14.1 Summary of Technical Information in the Application

The Nonessential Cooling Water System consists of the circulating water, service water, screen wash, chemical feed, gland water, and lake makeup and blowdown systems.

LRA Section 2.3.3.14 states that the purpose of the Nonessential Cooling Water System is to provide cooling water to the main condensers and other plant heat exchangers. The Nonessential Cooling Water System is in scope for license renewal. However, portions of the Nonessential Cooling Water System are not required to perform intended functions and are not included in the scope of license renewal. The Nonessential Cooling Water System is a normally operating system.

LRA Section 2.3.3.14 states that the purposes of Nonessential Cooling Water plant systems are as follows:

- The purpose of the circulating water system is to provide the condensers with a continuous supply of cooling water.

- The purpose of the service water system is to supply cooling water for the turbine-generator and miscellaneous HVAC loads, fuel pool cooling, and the heat exchangers in the TBCCW and RBCCW systems.
- The purpose of the screen wash system is to provide water to wash and remove debris from the traveling screens in the Lake Screen House.
- The purpose of the chemical feed system is to minimize the macroscopic biological fouling and microbiologically-influenced corrosion in plant systems.
- The purpose of the gland water system is to provide cooling water to plant equipment.
- The purpose of the lake makeup and blowdown system is to maintain an acceptable water level in the Cooling Lake, control dissolved solids in the Cooling Lake water, and dilute and discharge low-level radioactive wastes.

The intended functions of the Nonessential Cooling Water System within the scope of license renewal include the following:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The system contains nonsafety-related fluid-filled lines in the Reactor Building, Turbine Building, and Auxiliary Building that have the potential for spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The system provides a source of fire water and provides a credited backup in the event that the diesel fire pumps are unavailable (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-14 identifies the Nonessential Cooling Water System component types within the scope of license renewal and subject to an AMR.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14; UFSAR Sections 9.2.2, 9.2.12, and 10.4.5; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.14.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Nonessential Cooling Water System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.15 Nonsafety-Related Ventilation System

2.3.3.15.1 Summary of Technical Information in the Application

LRA Section 2.3.3.15 states that the purpose of the Nonsafety-Related Ventilation (NSV) System is a normally operating system designed to maintain a favorable environment for plant equipment and personnel while preventing the spread of contamination in the plant. The NSV System consists of various ventilation plant systems and the station heat recovery plant system.

The NSV System provides ventilation to the following plant areas:

- Auxiliary Building equipment areas
- Auxiliary Building laboratory
- Lake Screen House
- machine shop
- Offgas Building
- Radwaste Building
- Service Building
- Service Building storeroom
- interim radwaste storage facility
- River Screen House
- QA records vault
- 345-kV relay house

The NSV System also includes the station heating and recovery plant system, which recycles heat from ventilation exhaust air to preheat ventilation intake air in the winter time, and provides supplemental cooling in the summer time.

The intended function of the NSV System for license renewal is to maintain leakage boundary integrity to preclude system interactions. This system is not required to operate to support license renewal intended functions and is in scope for potential spatial interaction. In addition, the intended function is to resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The NSV System includes nonsafety-related water-filled piping and components located in the Auxiliary Building that have the potential for spatial interactions (spray or leakage) with safety-related SSCs (10 CFR 54(a)(2)).

The NSV System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or are relied on to remain functional during and following DBEs. The NSV System meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of a function(s) identified for 10 CFR 54.4(a)(1). The NSV System is not in scope under 10 CFR 54.4(a)(3) because it is not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63).

The intended function of the NSV System within the scope of license renewal includes the following:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The NSV system includes nonsafety-related water-filled piping and components located in the Auxiliary Building that have the potential for spatial interactions (spray or leakage) with safety-related SSCs (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-15 identifies the NSV System component types within the scope of license renewal and subject to an AMR.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15, the UFSAR, and LRA Table 2.3.3-15 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 UFSAR 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 being within the scope of license renewal to verify that it 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).

2.3.3.15.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concluded that the applicant appropriately identified the NSV System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.16 Plant Drainage System

2.3.3.16.1 Summary of Technical Information in the Application

The Plant Drainage System includes components from the following plant systems:

- equipment and floor drainage systems
- HVAC equipment drain system
- generator vent and drain system
- roof drain system
- wastewater treatment system
- sewage treatment system

LRA Section 2.3.3.16 states that the purpose of the normally operating Plant Drainage System is to collect various liquid wastes generated in the operation of the plant. The Plant Drainage System is in scope for license renewal. However, portions of the Plant Drainage System are not required to perform intended functions and are not in scope.

The purposes of the Plant Drainage System plant systems are as follows:

- The purpose of the equipment and floor drainage system is to collect radioactive, nonradioactive, and oily liquid wastes generated in the operation of the plant. The system collects waste liquids from their points of origin and transfers them for eventual processing. Radioactive, nonradioactive, and oily wastes are segregated and processed separately.
- The purpose of the HVAC equipment drain system is to prevent water accumulation within HVAC ventilation units. The HVAC equipment drain system collects condensate from the ventilation unit plenums and drains it for eventual processing. The HVAC equipment drain system is not required to operate to support license renewal intended functions. Only the exposed, nonembedded portions of the HVAC equipment drain system, which have potential spatial interaction with safety-related equipment in the

Reactor Building, Auxiliary Building, and Turbine Building, perform a license renewal intended function and are in scope for potential spatial interaction.

- The purpose of the generator vent and drain system is to collect equipment leakoff and drainage from the main turbine and associated components. The generator vent and drain system collects leakoff and drainage and transfers them for eventual processing. The generator vent and drain system does not perform a license renewal intended function.
- The purpose of the roof drain system is to prevent the accumulation of precipitation on plant building roofs. The roof drain system collects roof drainage and discharges it into the storm drain system. The roof drain system is not required to operate to support license renewal intended functions. Only the exposed, nonembedded portions of the roof drain branch lines and headers, which have potential spatial interaction with safety-related equipment in the Reactor Building, Auxiliary Building, and Diesel Generator Building, perform a license renewal intended function and are in scope for potential spatial interaction.
- The purpose of the wastewater treatment system is to process the station's wastewater to comply with state and Federal U.S. Environmental Protection Agency guidelines regulating the effluent returned to the cooling lake. The wastewater system processes plant waste water through oil separators, equalization tanks, flocculator-clarifier tanks, and media filters before releasing it through the cooling lake discharge flume. The wastewater treatment system does not perform a license renewal intended function.
- The purpose of the sewage treatment system is to collect and process plant sewage to meet the effluent quality limits set by the Illinois Environmental Protection Agency. The sewage treatment system collects sanitary waste through the sanitary waste drain system and transfers the waste to lift stations for processing through primary and secondary aerated lagoon cells. The sewage treatment system is not required to operate to support license renewal intended functions. Only the exposed, nonembedded portions of the sanitary waste drain system, which have potential spatial interaction with safety-related equipment in the Auxiliary Building, perform a license renewal intended function and are in scope for potential spatial interaction.

The intended functions of the Plant Drainage System within the scope of license renewal include the following:

- Provide primary containment boundary. The system includes safety-related primary containment isolation valves (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The nonsafety-related floor drain system in the Reactor Building is credited for the mitigation of flooding as a result of a high-energy line break (HELB) or a moderate-energy line break. Additionally, the nonsafety-related drywell drain lines that are routed through the suppression chamber airspace before exiting the primary containment are in scope to ensure their pressure boundary integrity to prevent drywell to suppression chamber bypass leakage (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The system contains components that are environmentally qualified (10 CFR 54.4(a)(3)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The floor drain systems in the Auxiliary Building, Diesel Generator Building, and Turbine Building are credited for the removal of fire water from areas containing safe shutdown equipment. The floor drain system in the Diesel Generator Building is credited to prevent the accumulation of oil in areas containing safe shutdown equipment (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-16 identifies the Plant Drainage System component types within the scope of license renewal and subject to an AMR.

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16, UFSAR Section 9.3.3, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.16-1, the staff notes on drawing LR-LAS-M-142-1 (A-4) that the staff could not locate seismic or equivalent anchors between the safety and nonsafety interface at the F.4.c termination symbol (valve 2E12-F070) and the end of the 10 CFR 54.4(a)(2) scoping boundary. The NRC requested that the applicant provide additional information to locate the seismic or equivalent anchors between the safety and nonsafety interface and the end(s) of the 10 CFR 54.4(a)(2) scoping boundary.

In its response letter dated August 26, 2015, the applicant provided the location of additional equivalent anchors.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.16-1 acceptable because the applicant provided the location of additional equivalent anchors to the end of the 10 CFR 54.4(a)(2) scoping boundary. Therefore, the staff's concern described in RAI 2.3.3.16–1 is resolved.

2.3.3.16.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Plant Drainage System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.17 Primary Containment Ventilation System

2.3.3.17.1 Summary of Technical Information in the Application

LRA Section 2.3.3.17 states that the purpose of the Primary Containment Ventilation (PCV) System is to maintain a suitable environment inside the drywell for equipment operation and longevity. It is a normally operating system designed to limit the maximum average temperature of the air to maintain drywell air temperature within equipment operating limits. The PCV

System is in scope for license renewal; however, portions of the PCV System are not required to perform intended functions and are not in scope. A portion of the PCV System performs a safety-related function. The chilled water piping that penetrates primary containment and the associated primary containment isolation valves are safety-related components that are relied on to provide the primary containment boundary and are also environmentally qualified.

The intended functions of the PCV System within the scope of license renewal include the following:

- Provide primary containment boundary. The PCV System contains safety-related primary containment isolation valves in the chilled water piping to and from the drywell (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The PCV System includes nonsafety-related water-filled piping and components that have the potential for spatial interactions (spray or leakage) with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The PCV System contains components associated with the primary containment isolation valves that are environmentally qualified (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-17 identifies the PCV System component types within the scope of license renewal and subject to an AMR.

2.3.3.17.2   Staff Evaluation

The staff reviewed LRA Section 2.3.3.17 using the evaluation methodology described in SER Section 2.3, the UFSAR, and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and UFSAR 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 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).

2.3.3.17.3   Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concluded that the applicant appropriately identified the PCV System components within the scope of license renewal as required by 10 CFR 54.4(a), and that the applicant has adequately identified all the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.18   Process Radiation Monitoring System

2.3.3.18.1   Summary of Technical Information in the Application

LRA Section 2.3.3.18 states that the purposes of the Process Radiation Monitoring System are to monitor the level of radioactivity of various process liquid and gas lines that can serve as discharge routes for radioactive materials; provide indication and record of detected levels; and, for certain systems, support the prevention of an uncontrolled release of radioactive liquids, gases, and particulates by providing isolation signals to the monitored systems.

The normally operating Process Radiation Monitoring System consists of safety-related and nonsafety-related portions and is in scope for license renewal. However, portions of the Process Radiation Monitoring System are not required to perform intended functions and are not in scope.

The Process Radiation Monitoring System consists of the following monitors:

- main steam line radiation monitors
- Reactor Building ventilation exhaust radiation monitors
- fuel floor vent plenum exhaust radiation monitors
- control room ventilation intake radiation monitors
- standby gas treatment stack effluent monitor
- RHR service water effluent radiation monitors
- service water effluent radiation monitor
- liquid radwaste effluent radiation monitor
- RBCCW radiation monitor
- off-gas pre-treatment monitor
- off-gas post-treatment monitor
- off-gas carbon bed vault monitor
- station vent stack effluent radiation monitor

The intended functions of the Process Radiation Monitoring System within the scope of license renewal include the following:

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The Process Radiation Monitoring System monitors plant processes for radiation level and initiates appropriate protective action to limit the potential release of radioactive materials. The reactor building ventilation exhaust and fuel floor vent plenum exhaust radiation monitors initiate primary and secondary containment isolation and initiate the SGT system. The CRV intake radiation monitors isolate the normal outside air supply (10 CFR 54.4(a)(1)).

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Some nonsafety-related portions of the system provide structural restraint or support for safety-related components. Some nonsafety-related portions of the system are liquid-filled and have the potential for spatial interaction with safety-related equipment in the Reactor and Auxiliary Buildings (10 CFR 54.4(a)(2)).

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The station vent stack wide-range radiation monitor is credited to sense process conditions and to generate signals to actuate control room alarms to prompt operator actions in response to a radioactive gas waste system leak or abnormal operational transient (10 CFR 54.4(a)(2)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The process radiation monitoring system includes safety-related electrical equipment that is environmentally qualified to remain functional during post-accident conditions (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-18 identifies the Process Radiation Monitoring System component types within the scope of license renewal and subject to an AMR.

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18; UFSAR Sections 6.4, 7.1.2, 7.3.4, 7.6.1, 7.7.14, 9.4.1, and 11.5; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.18.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Process Radiation Monitoring System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.19 Process Sampling and Post Accident Monitoring System

2.3.3.19.1 Summary of Technical Information in the Application

The Process Sampling and Post Accident Monitoring System consists of the containment monitoring system, process sampling system, and post-accident sampling system.

LRA Section 2.3.3.19 states the purposes of the Process Sampling and Post Accident Monitoring System are to provide indication of critical parameters within containment; to obtain representative samples from process streams and convey them to central sample stations for use in minimizing leakage, spillage, and potential radiation exposure during normal operations; and to collect liquid and gaseous samples of the reactor coolant and containment atmosphere following a post-accident condition. The Process Sampling and Post Accident Monitoring System is a normally operating system.

The purpose of the containment monitoring system is to provide indication and alarms for the following containment parameters during normal and abnormal operating conditions:

- drywell and suppression chamber pressure
- drywell, suppression chamber, and suppression pool temperature
- suppression pool and containment flooding water levels
- drywell and suppression chamber oxygen and hydrogen concentrations
- drywell gross radiation and drywell and suppression chamber airborne radiation levels

The purpose of the process sampling portion of the system is to provide the capability for sampling various process systems during normal plant power operation and shutdown conditions. It accomplishes this purpose by taking representative samples from various process lines.

The purpose of the post-accident sampling portion of the system is to obtain representative liquid and gas grab samples from the reactor coolant system and within containments for radiological and chemical analysis under accident conditions.

The intended functions of the Process Sampling and Post Accident Monitoring System within the scope of license renewal include the following:

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The system includes containment pressure instrumentation that actuates a reactor trip and an actuation of the ECCS and primary and secondary containment isolation (10 CFR 54.4(a)(1)).
- Provide primary containment boundary. The system includes piping and isolation valves that are part of the primary containment boundary (10 CFR 54.4(a)(1)).
- Control combustible gas mixtures in the primary containment atmosphere. The system includes equipment that samples the containment atmosphere and provides indication of oxygen and hydrogen concentration (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Some portions of the nonsafety-related Process Sampling and Post-Accident Monitoring System are relied on to preserve the structural support intended function of the safety-related piping used for sampling and instrumentation and for containment isolation. Some portions of the sampling system may be liquid-filled and have the potential for spatial interaction with safety-related equipment in the Reactor and Auxiliary Buildings (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). Suppression pool instrumentation for level and temperature supports fire safe shutdown requirements (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). Containment monitoring instrumentation is required to remain functional following a design basis LOCA (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). Suppression pool instrumentation for level and temperature supports SBO under coping requirements (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-19 identifies the Process Sampling and Post Accident Monitoring System component types within the scope of license renewal and subject to an AMR.

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19; UFSAR Sections 7.5.2, 9.3.2, and 11.5.5; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.19.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Process Sampling and Post Accident Monitoring System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.20 Radwaste System

2.3.3.20.1 Summary of Technical Information in the Application

The Radwaste System includes the liquid radwaste system, gaseous radwaste system, and solid radwaste system.

The purpose of the liquid radwaste system is to collect, monitor, and process all potentially radioactive liquid wastes produced by the station. The waste/equipment drain processing subsystem collects and processes high-purity (low-conductivity) sources of radioactive liquid waste, such as plant equipment drains. This water is treated by settling, filtration, and demineralization and is returned for station reuse through the cycled condensate storage tank. The liquid radwaste plant system includes the following subsystems:

- waste/equipment drain processing subsystem
- floor drain processing subsystem
- chemical waste subsystem
- laundry waste subsystem
- sludge subsystem

The purpose of the solid radwaste plant system is to process all radioactive wet solid wastes produced by the station. The solid radwaste system accomplishes this by receiving, dewatering, solidifying, packaging, handling, and providing temporary storage for radioactive wet solid wastes, such as expended demineralizer resins and spent precoat material, before offsite shipment and disposal. The solid radwaste system also receives, decontaminates, and/or compacts, and provides temporary storage for, all radioactive dry wastes produced by the station before offsite shipment and disposal.

The purpose of the gaseous radwaste plant system is to process and control the release of gaseous radioactive wastes to the site environment. The gaseous radwaste system accomplishes this through the use of high-temperature catalytic recombining, holdup for decay, high-efficiency particulate filtration, and charcoal adsorption before discharge to the station vent stack.

The intended function of the Radwaste System within the scope of license renewal is:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Radwaste System contains nonsafety-related fluid-filled lines in the Reactor Building and Auxiliary Building, which have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-20 identifies the Radwaste System component types within the scope of license renewal and subject to an AMR.

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20; UFSAR Sections 11.2, 11.3, and 11.4; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3

and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.20.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified Radwaste System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.21 Reactor Water Cleanup System

2.3.3.21.1 Summary of Technical Information in the Application

LRA Section 2.3.3.21 states that the purpose of the Reactor Water Cleanup (RWCU) System is to remove solid and dissolved impurities from recirculated reactor coolant; discharge excess reactor water during startup, shutdown, and hot standby conditions; minimize temperature gradients in the recirculation piping and vessel during periods of low flow rates; and conserve reactor heat. The RWCU System accomplishes these operations by forced circulation of reactor coolant through regenerative and nonregenerative heat exchangers and filter demineralizers. The RWCU System also provides for monitoring the durability and effectiveness of noble metal compounds deposited on reactor vessel and piping surfaces by processing reactor coolant through a material monitoring system and a data acquisition system.

The intended functions of the RWCU System within the scope of license renewal include the following:

- Provide reactor coolant pressure boundary. The RWCU System includes a safety-related remote manual-operated valve on the return line to the reactor to provide long-term leakage control in the event of a piping failure in the RWCU System (10 CFR 54.4(a)(1)).
- Provide primary containment boundary. The RWCU System includes a safety-related remote manual-operated primary containment isolation valve on the return line to the reactor (10 CFR 54.4(a)(1)).
- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The RWCU System includes safety-related flow elements and instrumentation for the determination of RWCU System high differential flow. The high differential flow signal is an indication of leakage or a break in RWCU piping and is used to automatically isolate the RWCU System from the reactor coolant pressure boundary (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The RWCU System contains nonsafety-related high-energy and moderate-energy lines in the Reactor Building and Auxiliary Building, which provide structural support or have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The RWCU blowdown flow control valve, RWCU discharge to main condenser valve, and

RWCU drain to waste surge tanks valve are credited as high-low pressure interfaces for fire safe shutdown (10 CFR 54.4(a)(3)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The RWCU System includes an environmentally qualified remote manual-operated valve on the return line to the reactor (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-21 identifies the RWCU System component types within the scope of license renewal and subject to an AMR.

2.3.3.21.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.21, UFSAR Section 5.4.8, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results.

In RAI 2.3.3.21-1, the staff notes that Unit 1 drawing LR-LAS-M-97-1 shows 10 CFR 54.4(a)(1) piping whose scope changes to 10 CFR 54.4(a)(2), whereas the piping classification changes to "Class C," indicating ASME Section III Class 3 piping at the following locations:

LR-LAS-M-97, Sheet-1, Location	Piping ID
Location E-7	Line 1RT01C 4 downstream of valve 1G33-F004
Location F-4	Line 1RT06B 4 downstream of valve 1G33-F040

Similarly for Unit 2, drawing LR-LAS-M-143, Sheet-1, shows 10 CFR 54.4(a)(1) piping whose scope changed to 10 CFR 54.4(a)(2), whereas the piping classification changes to "Class C," indicating ASME Section III Class 3 piping at the following locations:

LR-LAS-M-143, Sheet-1, Location	Piping ID
Location E-7	2RT01C 4 downstream of valve 2G33-F004
Location F-4	2RT06B 4 downstream of valve 2G33-F040

The NRC requested that the applicant provide sufficient information to clarify the change in scoping classification.

In its response letter, dated August 26, 2015, the applicant stated that these piping sections are properly scoped as being in scope for 10 CFR 54.4(a)(2) intended functions. These piping sections are classified within the LSCS current design basis as nonsafety-related, and they do not have 10 CFR 54.4(a)(1) intended functions.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.21-1 acceptable because the applicant clarified that the piping sections designated with Quality Group Classification "C" (ASME Code Section III, Class 3) listed in RAI 2.3.3.21-1 are outside of the RCPB and primary containment boundary and are nonsafety-related, are nonseismic, and do not have 10 CFR 54.4(a)(1) intended functions. Therefore, the staff's concern described in RAI 2.3.3.21–1 is resolved.

2.3.3.21.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, RAI response, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the RWCU System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.22 Safety-Related Ventilation System

2.3.3.22.1 Summary of Technical Information in the Application

LRA Section 2.3.3.22 states that the Safety-Related Ventilation (SRV) System is a normally operating system designed to provide a favorable environment for plant equipment and personnel while preventing the spread of contamination in the plant. The SRV System also includes dampers and ductwork that are part of the secondary containment boundary. The SRV System is in scope for license renewal. The SRV license renewal system consists of the following plant systems:

- Reactor Building ventilation system
- ECCS equipment cooling ventilation system
- diesel generator room ventilation system
- switchgear heat removal system
- Turbine Building ventilation system

The intended functions of the SRV System within the scope of license renewal include the following:

- Maintain emergency temperature limits within areas containing safety-related components (10 CFR 54.4(a)(1)).
- Provide secondary containment boundary (10 CFR 54.4(a)(1)).
- Provide a pathway to the station vent stack for the potential release of fission products following certain abnormal operating conditions (10 CFR 54.4(a)(2)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 40.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-22 identifies the SRV System component types within the scope of license renewal and subject to an AMR.

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22, the UFSAR, and LRA Table 2.3.3-22 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 UFSAR 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 being within the scope of license renewal to verify that it 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).

2.3.3.22.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concluded that the applicant appropriately identified the SRV System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.23 Standby Liquid Control System

2.3.3.23.1 Summary of Technical Information in the Application

LRA Section 2.3.3.23 states that the primary purpose of the Standby Liquid Control (SLC) System is to shut down the reactor independent of the CRD System. The SLC System accomplishes this operation by injecting sodium pentaborate solution directly into the reactor vessel to absorb thermal neutrons. The SLC System operation is also credited during a LOCA to maintain suppression pool water pH at acceptable levels to minimize the radiological release to the environment. The SLC System is capable of satisfying the requirements of the system generic design basis, as well as the requirement for the reduction of risks from an ATWS as specified in 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light- Water-Cooled Nuclear Power Plants."

The SLC System is a standby system that is manually operated to shut down the reactor if the normal reactivity control provisions become inoperative. The system is designed to bring the reactor to a shutdown condition at any time in core life independent of control rod insertion capability. The most severe requirement for which the system is designed is shutdown from a full power operating condition assuming complete failure of the CRD System to respond to a scram signal. The SLC System is in scope for license renewal. However, portions of the SLC System are not required to perform intended functions and are not in scope.

The intended functions of the SLC System within the scope of license renewal include the following:

- Introduce emergency negative reactivity to make the reactor subcritical. The SLC System provides backup capability for reactivity control, independent of normal reactivity control provisions in the nuclear reactor, to be able to shut down the reactor if the normal control becomes inoperative (10 CFR 54.4(a)(1)).
- Control and treat radioactive materials released to the secondary containment. In the event of a LOCA, the SLC System is manually initiated from the control room to pump sodium pentaborate into the reactor to maintain the suppression pool pH at a level of 7.0 or higher to minimize iodine releases from primary containment to the environment (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The SLC System includes nonsafety-related fluid-filled lines in

the Reactor Building, which have the potential for spatial and structural interaction with safety-related SSCs (10 CFR 54.4(a)(2)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for ATWS (10 CFR 50.62). The SLC System injects sodium pentaborate solution into the reactor to achieve shutdown for mitigation of an ATWS (10 CFR 54.4(a)(3)).

LRA Table 2.3.3-23 identifies the SLC System component types within the scope of license renewal and subject to an AMR.

2.3.3.23.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.23, UFSAR Section 5.4.8, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.23.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the SLC System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.24 Suppression Pool Cleanup System

2.3.3.24.1 Summary of Technical Information in the Application

LRA Section 2.3.3.24 states that the purpose of the Suppression Pool Cleanup (SPC) System is to provide a means of improving the quality of the water in the suppression pool and transferring suppression pool water to the reactor well and the dryer-separator well in support of refueling operations. The SPC System can also be used to transfer suppression pool water to the main condenser. The SPC System does not have safety-related functions. The SPC System is in scope for license renewal. However, portions of the SPC System are not required to perform intended functions and are not in scope.

The intended function of the SPC System within the scope of license renewal is:

- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The SPC System contains nonsafety-related fluid-filled lines in the Reactor Buildings, Turbine Buildings, and Auxiliary Building that have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).

LRA Table 2.3.3-24 identifies the SPC System component types within the scope of license renewal and subject to an AMR.

2.3.3.24.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.24, UFSAR Section 9.2.11, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.24.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the SPC System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.3.25 Traversing Incore Probe System

2.3.3.25.1 Summary of Technical Information in the Application

LRA Section 2.3.3.25 states the primary purpose of the Traversing Incore Probe (TIP) System is to measure local neutron flux at various locations throughout the core in support of calibrating the Local Power Range Monitor (LPRM) Neutron Monitoring System detectors. The TIP System accomplishes its purpose by using neutron monitoring detectors and positioning systems capable of moving the flux detectors to various locations in the core corresponding to the locations of the LPRM detectors. The moveable TIP detectors generate signals that are processed to indicate local power in the vicinity of each LPRM detector. The TIP System is in scope for license renewal. However, portions of the TIP System are not required to perform intended functions and are not in scope.

The intended function of the TIP System within the scope of license renewal is:

- Provide primary containment boundary. The TIP System ball valves, shear valves, and TIP tubing between the shear valves and the primary containment penetrations form a primary containment boundary (10 CFR 54.4(a)(1)).

LRA Table 2.3.3-25 identifies the TIP System component types within the scope of license renewal and subject to an AMR.

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25, UFSAR Section 7.7.6.4, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.3.25.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA and UFSAR, the staff concludes that the applicant appropriately identified the TIP System mechanical components within the scope of license renewal as required by

10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion System

LRA Section 2.3.4 identifies the Steam and Power Conversion System SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the Steam and Power Conversion System in the following LRA sections:

- LRA Section 2.3.4.1, "Condensate System"
- LRA Section 2.3.4.2, "Condenser and Air Removal System"
- LRA Section 2.3.4.3, "Feedwater System"
- LRA Section 2.3.4.4, "Main Steam System"
- LRA Section 2.3.4.5, "Main Turbine and Auxiliaries System"

The staff's findings on review of LRA Sections 2.3.4.1 – 2.3.4.5 are in SER Sections 2.3.4.1 – 2.3.4.5, respectively.

2.3.4.1 Condensate System

2.3.4.1.1 Summary of Technical Information in the Application

The Condensate System consists of the acid feed and caustic handling (no longer used and not in scope), clean condensate, condensate and condensate booster, condensate polishing, cycled condensate gland water, and cycled condensate systems.

LRA Section 2.3.4.1 states that the purpose of the Condensate System is to provide filtered and demineralized condensate from the condenser hotwell to the Feedwater System. The Condensate System also provides for the storage of clean and cycled condensate water for use in normal plant operations and refueling operations. The Condensate System is in scope for license renewal. However, portions of the Condensate System are not required to perform intended functions and are not in scope. The Condensate System is a normally operating system.

LRA Section 2.3.4.1 states that the purposes of Condensate System plant systems are as follows.

- The purpose of the clean condensate system is to provide clean (noncontaminated) reactor-grade water to various plant systems by distributing clean condensate from the clean condensate storage tank to plant equipment and water service connections located in the Turbine Building, Radwaste Building, Offgas Building, Service Building, Auxiliary Building, Reactor Building, Diesel Generator Building, and other areas in the plant.
- The purpose of the condensate and condensate booster systems is to provide a means of transferring water from the condenser hotwell to the suction of the reactor feed pumps.
- The purpose of the condensate polishing system is to remove dissolved and suspended solids from the condensate to maintain high-quality reactor feedwater by processing condensate through prefilters and condensate demineralizers.

- The purpose of the gland water system is to provide gland water to various nonsafety-related plant pumps by providing cycled condensate from the cycled condensate gland seal head tank to each pump gland.
- The purpose of the cycled condensate system is to provide the necessary source of condensate (potentially contaminated) to various systems in the plant and to provide additional water for online and refueling activities by distributing condensate from the cycled condensate storage tanks to various systems throughout the plant.

The intended functions of the Condensate System within the scope of license renewal include the following:

- Provide primary containment boundary. The clean condensate supply lines that penetrate the primary containment are equipped with manually operated primary containment isolation valves (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Condensate System contains nonsafety-related fluid-filled lines in the Primary Containment, Auxiliary Building, Reactor Building, Diesel Generator Building, Offgas Building, and Turbine Building that provide structural support or have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The cycled condensate storage tanks are credited for fire safe shutdown as a suction source for the RCIC System (10 CFR 54.4(a)(3)).

LRA Table 2.3.4-1 identifies the Condensate System component types within the scope of license renewal and subject to an AMR.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1; UFSAR Sections 5.4.6.3, 6.2.4.2.2, 9.2.7, 10.4.6, and 10.4.7; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.4.1.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the Condensate System mechanical components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.2 Condenser and Air Removal System

2.3.4.2.1 Summary of Technical Information in the Application

The Condenser and Air Removal System consists of the main condenser and main condenser evacuation plant systems.

LRA Section 2.3.4.2 states that the purposes of the Condenser and Air Removal System are to provide a heat sink for exhaust steam from the main turbine and reactor feed pump turbines during normal operation and to remove noncondensible gases from the condenser and exhaust them to the gaseous radwaste system. The Condenser and Air Removal System is in scope for license renewal. However, portions of the Condenser and Air Removal System are not required to perform intended functions and are not in scope. The Condenser and Air Removal System is a normally operating system.

The purposes of the Condenser and Air Removal System plant systems are as follows:

- The purpose of the main condenser is to provide a heat sink for turbine exhaust steam, turbine bypass steam, and other turbine cycle flows and to receive and collect flows for return to the reactor by passing circulating water through the condenser tubes to condense the steam from turbine exhausts and other sources, by removing noncondensible gases during normal operation and plant startup, and by providing a volume for collection and storage of condensate to be returned to the reactor.
- The purpose of the main condenser evacuation system is to maintain a vacuum in the condenser for the three low pressure turbine exhausts by removing the noncondensible gases from the condenser, including air in-leakage and dissociation products originating in the reactor, and by discharging them to the gaseous radwaste system. The system also functions to minimize the release of radioactivity to the environment following a control rod drop accident by manual isolation of the main condenser off-gas outlet isolation valves and manual trip of the mechanical vacuum pump when high radiation is detected in the main steam lines.

The intended functions of the Condenser and Air Removal System for license renewal include the following:

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. Main condenser low vacuum instrumentation initiates MSIV closure and main steam line drain isolation (10 CFR 54.4(a)(1)).
- Provide post-accident containment holdup and plateout of MSIV bypass leakage. The main condenser is credited for holdup and plateout of MSIV leakage following a LOCA (10 CFR 54.4(a)(2)).
- Minimize the release of radioactive material to the environment. Manual isolation of the main condenser off-gas outlet valves and manual tripping of the mechanical vacuum pump is credited following a control rod drop accident to minimize radioactive releases (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The Condenser and Air Removal System includes environmentally qualified pressure switches to sense loss of condenser vacuum (10 CFR 54.4(a)(3)).

LRA Table 2.3.4-2 identifies the Condenser and Air Removal System components within the scope of license renewal and subject to an AMR.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2; UFSAR Sections 6.8, 7.3.2.2.3.12, 10.4.1, 10.4.2, 15.4.9, and 15.6.5; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.4.2.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Condenser and Air Removal System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.3 Feedwater System

2.3.4.3.1 Summary of Technical Information in the Application

The Feedwater System consists of the feedwater, feedwater heaters and drains, feedwater miscellaneous drains, feedwater control, zinc injection, hydrogen, and hydrogen water chemistry systems.

LRA Section 2.3.4.3 states that the purpose of the Feedwater System is to provide a dependable supply of high quality feedwater to the reactor vessel. The Feedwater System is in scope for license renewal. However, portions of the Feedwater System are not required to perform intended functions and are not in scope. The Feedwater System is a normally operating system.

The purposes of the Feedwater System plant systems are as follows:

- The purpose of the feedwater system is to provide feedwater at the required flow, pressure, and temperature to the reactor vessel by taking high-quality, preheated feedwater from the feedwater heaters and injecting the feedwater into the reactor vessel using motor or turbine driven reactor feed pumps.
- The purpose of the feedwater heaters and drains/feedwater miscellaneous drains is to recover thermal energy for preheating feedwater to increase the thermal efficiency of the plant by using cascading drains and extraction steam to heat reactor feedwater through the use of feedwater heaters.
- The purpose of the feedwater control system is to automatically control the flow of feedwater into the reactor vessel to maintain the water level in the vessel within predetermined levels over the entire power range of the reactor.
- The purpose of the zinc injection system is to reduce dose rates in the reactor recirculation piping by reducing the level of cobalt that is incorporated into the iron oxide layers on the recirculation piping by injecting a solution of depleted zinc oxide into the suction header of the reactor feed pumps.

- The purpose of the hydrogen system is to provide a source of hydrogen for hydrogen water chemistry by providing regulated hydrogen from a cryogenic hydrogen storage facility to the hydrogen water chemistry injection system.
- The purpose of the hydrogen water chemistry system is to reduce rates of intergranular stress corrosion cracking in recirculation piping and reactor vessel internals by injecting hydrogen into the condensate booster pump suction header to suppress the formation of radiolytic oxygen in the reactor coolant.

The intended functions of the Feedwater System for license renewal include the following:

- Provide primary containment boundary. The system includes safety-related motor-operated primary containment isolation valves in the feedwater inlet lines to the reactor (10 CFR 54.4(a)(1)).
- Provide reactor coolant pressure boundary. The system includes safety-related motor-operated valves in the feedwater inlet lines to the reactor to provide long-term leakage control in the event of a piping failure in the Feedwater System (10 CFR 54.4(a)(1)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Feedwater System contains nonsafety-related fluid-filled lines in the Reactor Building, Auxiliary Building, and Turbine Building that provide structural support or that have potential spatial interactions with safety-related SSCs (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The Feedwater System motor-operated primary containment isolation valves include components that are environmentally qualified (10 CFR 54.4(a)(3)).

LRA Table 2.3.4-3 identifies the Feedwater System components within the scope of license renewal and subject to an AMR.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3; UFSAR Sections 5.4.15, 6.2, 7.7.4, and 10.4.7; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.4.3.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Feedwater System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.4 Main Steam System

2.3.4.4.1 Summary of Technical Information in the Application

The Main Steam System consists of the plant main steam system and MSIV leakage control system. The station MSIV leakage control system is abandoned in place for Unit 1 and deleted for Unit 2.

LRA Section 2.3.4.4 states the purposes of the Main Steam System are as follows:

- Provide the high-pressure steam produced by the reactor to the main turbine during normal plant operation through the four main steam lines between the outboard primary containment isolation valves, the main turbine stop valves, and the main turbine bypass valves.
- Provide the capability to bypass steam around the main turbine by operation of main turbine bypass valves that discharge to the main condenser.
- Provide steam to users, such as the reactor feed pump turbines, steam jet air ejectors, off-gas preheaters, second stage reheaters, and steam seal evaporator, by providing high-pressure steam from upstream of the main turbine stop valves to flow or pressure control valves at each of the steam users.
- Route the main steam relief valve (MSRV) discharge to the suppression pool to minimize the thermal effects of opening the relief valves by routing the steam from the MSRV into the suppression pool, below the normal water level, to a quencher to facilitate condensation of the steam.
- Contain MSIV leakage following a LOCA by providing a volume within the large diameter main steam piping for plateout and holdup and a flow path through main steam drain lines to the main condenser for additional plateout and holdup in the condenser.

The intended functions of the Main Steam System for license renewal include the following:

- Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The Main Steam System contains reactor protection system instrumentation that initiates reactor scram or turbine trip (10 CFR 54.4(a)(1)).
- Provide emergency heat removal from primary containment and provide containment pressure control. The Main Steam System includes the MSRV discharge piping, which prevents bypass leakage between the drywell and suppression pool and routes MSRV discharge to the suppression pool (10 CFR 54.4(a)(1)).
- Provide post-accident containment holdup and plateout of MSIV bypass leakage. The Main Steam System contains leakage from MSIVs and routes the leakage to the main condenser for holdup and plateout before release following a LOCA (10 CFR 54.4(a)(2)).
- Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Main Steam System includes nonsafety-related SSCs with the potential for spatial and structural interaction with safety-related SSCs in the Reactor Building (10 CFR 54.4(a)(2)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). The

Main Steam System includes the MSRV discharge piping, which is used to reduce and control reactor pressure to support fire safe shutdown (10 CFR 54.4(a)(3)).

- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for EQ (10 CFR 50.49). The Main Steam System contains reactor protection instrumentation that is subject to the requirements of 10 CFR 50.49 (10 CFR 54.4(a)(3)).
- Relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63). The Main Steam System includes the MSRV discharge lines, which are used during an SBO to reduce and control reactor pressure (10 CFR 54.4(a)(3)).

LRA Table 2.3.4-4 identifies the Main Steam System component types within the scope of license renewal and subject to an AMR.

2.3.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.4; UFSAR Sections 3.2, 6.7, 6.8, 10.3, and 15.6; and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.4.4.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Main Steam System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.3.4.5 Main Turbine and Auxiliaries System

2.3.4.5.1 Summary of Technical Information in the Application

The Main Turbine and Auxiliaries System consists of the turbine generator system, gland seal steam system, turbine lube oil system, electro-hydraulic control (EHC) system, turbine test system, and portions of the main steam system.

LRA Section 2.3.4.5 states that the purpose of the Main Turbine and Auxiliaries System is to convert the thermal energy in the steam supplied from the reactor into rotational mechanical energy. The Main Turbine and Auxiliaries System is in scope for license renewal; however, portions of the system are not required to perform intended functions and are not in scope. The Main Turbine and Auxiliaries System is a normally operating system.

The purposes of the Main Turbine and Auxiliaries System plant systems are as follows:

- The purpose of the main turbine is to convert the thermal energy in the steam produced by the reactor into rotational mechanical energy for use by the main generator in producing electricity and to provide a passive holdup volume in conjunction with the main condenser following an accident for any leakage through the MSIV using the exhaust hoods of the low pressure turbines, which are mounted on the top of the main condenser to form the boundary for holdup of MSIV leakage.

- The purpose of the gland seal steam system is to provide a source of clean steam to the shaft seals for the main high and low pressure turbine rotors; shaft seals for the reactor feed pump turbine rotors; and large main steam valves, including the main turbine stop valves, main turbine control valves, main turbine bypass valves, combined intermediate valves, and reactor feed pump turbine stop and control valves, by heating condensate during power operation in the steam seal evaporator.
- The purpose of the lube oil system is to provide clean pressurized oil to the main turbine thrust bearing, main turbine journal bearings, lift pump suction, hydrogen seal oil, and reactor feed pump turbine control system and bearings. It accomplishes this by purifying the lube oil and providing the pressurized oil to the selected users and returning it to the purification equipment.
- The purpose of the electro-hydraulic control system is to provide hydraulic fluid for control of main steam header pressure, turbine speed, and steam flow during normal operating and transient conditions by positioning the main steam stop valves, control valves, combined intermediate valves, and bypass valves.
- The purpose of turbine test system is to provide various system connection points so that thermal performance testing can be performed on the turbine assembly by installed instrumentation connection points to monitor process variables in the Main Turbine and Auxiliaries System. This turbine test system is only installed on Unit 2.

The intended function of the Main Turbine and Auxiliaries System for license renewal includes:

- Provide post-accident containment holdup and plateout of MSIV bypass leakage. Credit is taken for holdup and plateout in the main condenser for MSIV leakage. The low pressure turbine exhaust hoods form part of this holdup boundary with the main condenser (10 CFR 54.4(a)(2)).

LRA Table 2.3.4-5 identifies the Main Turbine and Auxiliaries System component types within the scope of license renewal and subject to an AMR.

2.3.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.5, UFSAR Section 10.2, and the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3. On the basis of its review, the staff did not identify the need for additional information.

2.3.4.5.3 Conclusion

Based on the results of the staff’s evaluation discussed in SER Section 2.3 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Main Turbine and Auxiliaries System components within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the system components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures and Component Supports

This section documents the staff's review of the applicant's scoping and screening results for Structures and Component Supports. Specifically, this section discusses systems and structures within the following LRA sections:

- LRA Section 2.4.1, "Auxiliary Building"
- LRA Section 2.4.2, "Component Supports Commodity Group"
- LRA Section 2.4.3, "Cooling Lake"
- LRA Section 2.4.4, "Diesel Generator Building"
- LRA Section 2.4.5, "Lake Screen House"
- LRA Section 2.4.6, "Offgas Building"
- LRA Section 2.4.7, "Primary Containment"
- LRA Section 2.4.8, "Radwaste Building"
- LRA Section 2.4.9, "Reactor Building"
- LRA Section 2.4.10, "Structural Commodity Group"
- LRA Section 2.4.11, "Switchyard Structures"
- LRA Section 2.4.12, "Tank Foundations and Dikes"
- LRA Section 2.4.13, "Turbine Building"
- LRA Section 2.4.14, "Yard 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, "Scope," 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 UFSAR, 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.

2.4.1 Auxiliary Building

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 states that the purpose of the Auxiliary Building is to provide structural support, shelter, and protection to SSCs along with personnel housed within the building during normal plant operations and during and following postulated DBAs and extreme environmental conditions. The Auxiliary Building is a seismic Category I safety-related multiple-story structure comprised of a reinforced concrete shear wall structure supported on a reinforced concrete mat foundation on soil. The building meets the regulation at 10 CFR 54.4(a)(1) because it is relied on to remain functional during and following DBEs and regulation at 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure could prevent satisfactory accomplishment of a function(s) identified for 10 CFR 54.4(a)(1). The building also provides protection for SSCs that are within the scope of license renewal to support regulated events pursuant to 10 CFR 54.4(a)(3).

The Auxiliary Building is designed to maintain its structural integrity during and following postulated DBAs and extreme environmental conditions. According to Table 3.2-1 (note 34) of the UFSAR, shear walls are considered Category I for the Reactor Building, Auxiliary Building, Turbine Building, Radwaste Building, Diesel Generator Buildings, and Off-gas Filter Building because they are all interconnected and act together to resist lateral loads applied to these structures.

The LRA states that fire barriers, component supports, and structural commodities are evaluated separately in other relevant systems and commodity groups and are not included within the evaluation boundary of the Auxiliary Building. In addition, mechanical and electrical systems and components housed in or located within the Auxiliary Building are evaluated with their respective mechanical and electrical license renewal system or commodity group. Included within the boundary of the Auxiliary Building and determined not to be within the scope of license renewal are certain architectural elements in the miscellaneous operational support areas, such as the computer room and labs that include drywall partitions and soffits and suspended ceilings.

The intended functions of the Auxiliary Building within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs, provide a centralized area for control and monitoring of safety-related equipment, provide for the discharge of treated gaseous waste, and control the potential release of fission products to the external environment so that offsite consequences of DBEs are within acceptable limits (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1) (10 CFR 54.4(a)(2)).
- Provide structural support or restraint to SSCs not in scope of license renewal to prevent interaction with safety-related SSCs (10 CFR 54.4(a)(2)).

- Provide physical support, shelter, and protection for systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-1 identifies the Auxiliary Building component types within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-1.

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1; UFSAR Sections 3.5, 6.4, 9.5, and 12.3; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed Section 3.8.4 of the UFSAR to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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

Based on the results of the staff’s evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Auxiliary Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.2 Component Supports Commodity Group

2.4.2.1 Summary of Technical Information in the Application

In LRA Section 2.4.2, the applicant described the Component Supports Commodity Group consisting of structural elements and specialty components designed to transfer the load applied from an SSC to the building structural element or directly to the building foundation. Supports include seismic anchors or restraints, support frames, constant and variable spring hangers, rod hangers, guides, stops, straps, and clamps. Snubbers are also included in the boundary of this commodity group but are considered active components and are not subject to an AMR except for the end connections, which perform a passive function for structural support. The commodity group includes supports for ASME Code Class 1, 2, and 3 and metal components piping and components, including reactor vessel anchorage, cable trays, HVAC ducts; emergency diesel generators; platforms; spray shields; miscellaneous structures; racks; panels; and cabinets and enclosures for electrical equipment and instrumentation. The Component Supports Commodity Group includes supports for mechanical, electrical, and instrumentation SSCs that are within the scope of license renewal and supports for SSCs that are not within the scope of license renewal but are required to restrain or prevent physical interaction with safety-related SSCs (e.g., seismic Category II over I).

The intended functions of the Component Supports Commodity Group within the scope of license renewal include the following:

- Provide structural support or restraint to safety-related SSCs in scope of license renewal (10 CFR 54.4(a)(1)).
- Provide structural support or restraint to SSCs not in scope of license renewal to prevent interaction with safety-related SSCs (10 CFR 54.4(a)(2)).
- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

The applicant evaluates concrete equipment foundations, concrete anchors, and embedments that are not included in the boundary of the Component Supports Commodity Group separately with the license renewal structure that contains them.

LRA Table 2.4-2 identifies the component types and intended functions of component supports that are subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-2.

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2; UFSAR Sections 3.6, 3.7, 3.9, 3.10 and 8.3; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in LRA Section 2.1 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.2.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Component Supports Commodity Group SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.3 Cooling Lake

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 states that the purpose of the safety-related Cooling Lake is to provide a source of cooling water for the Nonessential Cooling Water System, which includes the circulating water and service water systems. The upper portion of the Cooling Lake, including the embankment and discharge structure and discharge flume, are not safety-related and do not perform an intended function for license renewal. The submerged core standby cooling system (CSCS) pond and intake flume, as well as the CSCS outfall structure, which are located within the Cooling Lake, are classified as safety-related. The purpose of the CSCS pond and intake flume is to provide the UHS by providing water for the ECW System and also for the Fire Protection System. The CSCS pond and intake flume are in scope for license renewal because they are classified as seismic Category I safety-related structures required to maintain structural integrity and an adequate volume of cooling water for safety-related systems during DBEs.

The CSCS outfall structure is a safety-related concrete structure that directs return water into the CSCS pond and is in scope for license renewal. However, the makeup pipeline outfall structure and makeup and blowdown valve house, service spillway, and auxiliary spillway do not perform an intended function for license renewal and, therefore, are not in scope. The evaluation boundary includes the cooling lake embankment (including discharge structure and flume), submerged CSCS pond and intake flume, the UHS, CSCS pipeline outfall structure, makeup pipeline outfall structure, and makeup and blowdown valve house, service spillway (blowdown intake structure), and the auxiliary spillway.

Not included in the boundary of the Cooling Lake are the Lake Screen House and the retaining walls on the north and south sides of the Lake Screen House, which are evaluated separately with the Lake Screen House. The shad net (cable, polymer, and steel components) are included within the ECW System; however, the anchors are within the scope of the Cooling Lake.

The intended functions of the Cooling Lake within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs, provide UHS during DBEs, and provide a source of cooling water for plant safe shutdown (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of functions(s) identified for 10 CFR 54.4(a)(1) (10 CFR 54.4(a)(2)).
- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-3 identifies the Cooling Lake component types within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-3.

2.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.3; UFSAR Sections 2.4, 2.5, 9.2, 10.4, and 11.2; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.3.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Cooling Lake SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.4 Diesel Generator Building

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4.4 states that the purpose of the Diesel Generator Building is to provide structural support, shelter, access control, and protection to safety-related SSCs housed within it during operation, shutdown, and postulated DBAs. Each Diesel Generator Building is a multiple-level seismic Category I structure that is part of the power generation complex. The shear walls for the Reactor Building, Auxiliary Building, Turbine Building, Radwaste Building, Diesel Generator Buildings, and Off-gas Filter Building are seismic Category I and interconnected to act together to resist lateral loads applied to these buildings. Major components contained within the building include the emergency diesel generators, fuel oil storage and day tanks, electrical switchgear, HVAC diesel compartment cooling and ventilation equipment, and miscellaneous equipment required to support the operation and maintenance of the emergency diesel generators. The buildings are comprised of a multiple-level reinforced concrete substructure supported on a reinforced concrete mat foundation on soil with a steel frame above the grade floor and are designed to withstand tornadoes, missiles, and flooding.

The intended functions of the Diesel Generator Building within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for safety-related SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-4 identifies the Diesel Generator Building component types within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-4.

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4; UFSAR Sections 1.2, 3.5, 3.7, and 9.5; UFSAR Table 3.2-1; UFSAR Appendix H – "Fire Hazards Analysis"; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.4.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Diesel Generator Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.5 Lake Screen House

2.4.5.1 Summary of Technical Information in the Application

LRA Section 2.4.5 states that the purpose of the Lake Screen House is to provide structural support, shelter, protection, and access to submerged CSCS pond water (UHS) for seismic Category I safety-related concrete structural components and mechanical components under postulated environmental and DBA loading conditions. The Lake Screen House, which is in scope for license renewal, also provides a water-retaining boundary for the Cooling Lake and protection and access to Cooling Lake water for non-seismic Category I plant equipment and components, including fire protection pumps and associated piping, valves, and related equipment.

The non-seismic Category I Lake Screen House is a multiple-story building consisting of a reinforced concrete box-type structure, structural steel frame, and a precast concrete roof and is supported on a 4-ft-thick reinforced concrete mat foundation on soil. The Lake Screen House includes the seismic Category I service water tunnel, the two flume retaining walls, and the contiguous chemical feed building and is designed to provide protection for the service water tunnel and the associated safety-related piping and valve components. The building also provides a water-retaining boundary and access to the submerged portion of the CSCS.

The intended functions of the Lake Screen House within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs (10 CFR 54.4(a)(1)).
- Provide a source of cooling water for plant safe shutdown (10 CFR 54.4(a)(1)).
- Provide protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-5 identifies the components subject to an AMR and intended functions. The AMR results for these components are provided in LRA Table 3.5.2-5.

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.5; UFSAR Sections 1.2, 2.5, 3.3, 3.4, and 9.2; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.5.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Lake Screen House SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.6 Offgas Building

2.4.6.1 Summary of Technical Information in the Application

LRA Section 2.4.6 states that the purpose of the Offgas Building is to provide structural support, shelter, and protection for nonsafety-related SSCs during normal plant operation. Except for the seismic Category I shear walls, the Offgas Building is classified as a nonsafety-related seismic Category II structure that is in scope for license renewal. Also known as the Off-gas Filter Building, the Offgas Building is part of the power generation complex, which includes several contiguous buildings. The building consists of a reinforced concrete structural steel and metal siding with interior reinforced concrete and concrete block walls supported by a reinforced concrete mat foundation on soil. The building contains the off-gas filters and associated equipment components and the support systems and components necessary to support fire protection. The building is also designed to resist exterior flooding.

The intended functions of the Offgas Building within the scope of license renewal include the following:

- Provide structural support or restraint to SSCs in the scope of license renewal (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (10 CFR 54.4(a)(3)).

LRA Table 2.4-6 identifies the components subject to an AMR and intended functions. The AMR results for these components are provided in LRA Table 3.5.2-6.

2.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.6; UFSAR Sections 1.1, 1.2, 3.4, and 9.5; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.6.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Offgas Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.7 Primary Containment

2.4.7.1 Summary of Technical Information in the Application

LRA Section 2.4.7 states that the purpose of the Primary Containment is to provide a high integrity barrier to contain the effects of the postulated design basis line break and direct the steam released to the suppression chamber pool. The Primary Containment and internal structures provide structural support to safety- and nonsafety-related SSCs housed within. The steel-lined concrete drywell and suppression chamber walls provide a structural pressure barrier; water-retaining boundary; radiation shielding; and structural support for floors in the Reactor Building, including the refueling floor and pools. The Primary Containment is entirely in scope for license renewal.

The Primary Containment includes both Units 1 and 2 Primary Containment structures and the containment internal structures. Each Primary Containment is entirely enclosed and contained within the reinforced concrete Reactor Building, which provides secondary containment, shelter, and protection for the Primary Containment and the components housed within. The Primary Containment is a steel-lined, post-tensioned, reinforced concrete, Mark II type, safety-related seismic Category I structure consisting of a steel dome head and post-tensioned concrete wall standing on a base mat of conventionally reinforced concrete. Major systems and components in the Primary Containment include the reactor vessel and associated auxiliary systems, vent pipe system, containment cooling system, and the main steam safety relief valve discharge piping with associated quencher components. The Primary Containment consists of the following major structural components: Primary Containment wall, base foundation slab, liner plate and anchorages, penetrations and access hatches, drywell head, and internal structures.

The intended functions of the Primary Containment within the scope of license renewal include the following:

- Provide primary containment boundary, and provide physical support, shelter, and protection for safety-related SSCs (10 CFR 54.4(a)(1)).
- Provide sufficient air and water volumes to absorb the energy released to the containment in the event of DBEs so that the pressure is within acceptable limits and provides a source of water for ECCS (10 CFR 54.4(a)(1)).
- Control the potential release of fission products to the external environment so that offsite consequences of DBEs are within acceptable limits (10 CFR 54.4(a)(1)).
- Control the release of fission products to the secondary containment in the event of a design basis LOCA so that offsite consequences are within acceptable limits (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1) (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-7 identifies the Primary Containment components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-7.

2.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.4.7; UFSAR Sections 5.3 and 6.2; UFSAR Table 3.6-6, Table 6.1-1, and Table 6.2-1; and the license renewal boundary drawings (including LR-M-3 and LR-LAS-M-92 and 138) using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

UFSAR Section 9.4.10.2 states that debris screens are provided for all purge penetrations. However, LRA Section 2.4.7, "Primary Containment," and LRA Section 2.4.9, "Reactor Building," do not discuss or include such components in their respective tables for components subject to an AMR. In a letter dated May 14, 2015, the staff asked the licensee to clarify whether such a component is relied on to perform an intended function; identify where it is covered in the LRA; and, if not, provide a justification for its exclusion from the scope of license renewal.

In its response letter dated June 8, 2015, the licensee stated that the debris screens for the primary containment purge system are not scoped with either the Primary Containment or the Reactor Building. Instead, they are part of the containment vent and purge portion of the CGC system (LRA Section 2.3.3.2). They are in the scope of license renewal but were inadvertently omitted from the LRA. They perform an intended function to filter the air that passes through the containment vent and purge penetrations and are shown on drawings LR-LAS-M-92-1 and LR-LAS-M-138-1. LRA Tables 2.3.3-2 and 3.3.2-2 have been revised to include these components. The response also stated that an extent of condition review was performed to confirm other debris screens in similar configurations have been included in the LRA, and LRA Table 2.3.3-2 and Table 3.3.2-2 were revised to add new items. The staff finds the licensee's response acceptable.

2.4.7.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Primary Containment SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.8 Radwaste Building

2.4.8.1 Summary of Technical Information in the Application

LRA Section 2.4.8 states that the purpose of the Radwaste Building is to provide structural support, shelter, and protection for nonsafety-related SSCs that collect, monitor, process, package, and provide temporary storage facilities for radioactive wastes during plant operation. The Radwaste Building also provides physical support, shelter, and protection to portions of the Fire Protection System.

The Radwaste Building is classified as a nonsafety-related seismic Category II structure with shear walls designed to act together with the other power generation complex shear walls classified as seismic Category I. The building, which does not contain any safety-related equipment, is a multiple-story structure with above- and below-grade areas designed to preclude accidental release of radioactive materials to the environment. The building shell is reinforced concrete with interior concrete and block walls supported on a reinforced concrete mat foundation on soil. The Radwaste Building is, therefore, in scope for license renewal.

The intended functions of the Radwaste Building within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for nonsafety-related SSCs and components whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (10 CFR 54.4(a)(3)).

LRA Table 2.4-8 identifies the Radwaste Building components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-8.

2.4.8.2 Staff Evaluation

The staff reviewed LRA Section 2.4.8; UFSAR Sections 1.1, 1.2, 3.1, 3.4, 3.11, 7.7, 9.1, 9.4, 11.2, 11.4, 12.3, and 15.7 and Appendix E; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.8.3 Conclusion

Based on the results of the staff's evaluation discussed in LRA Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Radwaste Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.9 Reactor Building

2.4.9.1 Summary of Technical Information in the Application

LRA Section 2.4.9 states that the purpose of the Reactor Building is to provide secondary containment when the primary containment is in service and to provide primary containment during reactor refueling and maintenance operations when the primary containment is open. The building, which includes the seismic Category I equipment access building, provides structural support and protection to SSCs housed within during normal plant operation and during and following postulated DBAs and extreme environmental conditions.

The structure is a safety-related seismic Category I reinforced concrete structure, which also houses refueling and reactor servicing equipment, new and spent fuel storage facilities, and other reactor safety and auxiliary systems. The structure consists of poured-in-place, reinforced concrete exterior walls up to the refueling floor and supported on a reinforced concrete mat foundation on soil that is continuous under the Primary Containment, Auxiliary Building, Diesel Generator Buildings, and Turbine Buildings. The exterior walls of the building are designed to carry a negative pressure of 0.25 psig and will serve as the containment during shutdown when the primary containment vessel is open for refueling or maintenance. The building also includes a reinforced concrete main steam chase that connects the primary containment to the main steam tunnel protecting the main steam line piping from external missiles and that protects the other seismic Category I components in the building from the effect of steam in the unlikely event of a pipe rupture inside the chase.

The intended functions of the Reactor Building within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs (10 CFR 54.4(a)(1)).
- Provide protection for safe storage of new and spent fuel (10 CFR 54.4(a)(1)).
- Control the potential release of fission products to the external environment so that offsite consequences of DBEs are within acceptable limits (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-9 identifies the Reactor Building components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-9.

2.4.9.2 Staff Evaluation

The staff reviewed LRA Section 2.4.9; UFSAR Sections 1.1, 1.2, 3.1, 3.3, 3.4, 3.5, 3.11, 6.2, 9.1, and 9.5; UFSAR Table 3.2-1 (specifically notes 22 and 34); and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.9.3 Conclusion

Based on the results of the staff’s evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Reactor Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.10 Structural Commodity Group

2.4.10.1 Summary of Technical Information in the Application

LRA Section 2.4.10 states that the Structural Commodity Group shares material and environment properties allowing common programs across all in-scope structures to manage their aging effects. Structural Commodities include bird screens, cable trays, compressible joints and seals, conduit, doors, insulation and insulation jacketing, louvers, spray shields, miscellaneous steel, panels, racks, cabinets and other enclosures, penetration seals and sleeves, roofing, seals, gaskets, moisture barriers, tube track, structural bolting, and concrete anchors associated with these commodities. Structural Commodities are located in the structures that are within the scope of license renewal.

The intended functions of the Structural Commodity Group within the scope of license renewal include the following:

- Provide physical support, shelter, and protection for safety-related SSCs (10 CFR 54.4(a)(1)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), ATWS (10 CFR 50.62), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-10 identifies the Structural Commodity Group components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-10.

2.4.10.2 Staff Evaluation

The staff reviewed LRA Section 2.4.10; UFSAR Sections 3.4, 3.5, 5.2, 5.3, 6.1, 8.3, 9.4, and 9.5; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify structures classified as seismic Category I.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

UFSAR Section 3.4.1.4, "Flood Protection Measures," states, in part, that additional protection is provided by means of waterproofing and waterstops, all exterior walls to grade level are sealed with a waterproof membrane, and all exterior construction joints are sealed with waterstops to grade level. Seismic Category I structures that house safety-related equipment are the Reactor Building, Auxiliary Building, Diesel Generator Building, and Lake Screen House. The UFSAR includes components related to additional flood protection measures that are not included in the LRA tables for the relevant structures. In a letter dated May 14, 2015, the staff asked the applicant if the LRA addresses the waterstops and, if not, to provide a justification for their exclusion from the scope of license renewal.

In its response letter dated June 8, 2015, the applicant stated that the Structural Commodity Group scoping evaluation did not specifically identify waterstops because SRP-LR Table 2.4-1 states that waterstops do not need to be called out explicitly in the scoping or screening results if they are included as parts of structural components subject to an AMR. The response also stated that waterstops are included as integral parts of the reinforced concrete exterior below-grade structural components that are subject to an AMR and, therefore, are not called out explicitly in the scoping and screening or AMR results (also in accordance with SRP-LR Table 2.4-1). The waterproofing (waterproof membrane) applied to exterior below-grade walls does not provide an intended function for license renewal. The above- and below-grade exterior reinforced concrete (walls) and foundations provide the flood protection intended function as identified in LRA Tables 3.5.2-1, 3.5.2-4, 3.5.2-5, and 3.5.2-9 for the Auxiliary Building, Diesel Generator Building, Lake Screen House, and the Reactor Building. UFSAR Section 3.4.1.3 describes structures in the context of flood protection and lists buildings that resist exterior floods both above and below grade. The waterproof membrane is identified in UFSAR Section 3.4.1.4 as an additional protection feature provided only on exterior below-grade walls. The above- and below-grade exterior reinforced concrete (walls) and foundations provide the flood protection intended function as identified in the screening and AMR review results for the structures. The staff finds the licensee's response acceptable.

2.4.10.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Structural Commodity Group SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.11 Switchyard Structures

2.4.11.1 Summary of Technical Information in the Application

LRA Section 2.4.11 states that the purpose of the Switchyard Structures is to provide physical support, shelter, and protection for Offsite Power System components and to serve as the electrical transmission terminals for each unit. The Offsite Power System is relied on to provide offsite power during plant shutdown and in the event of a site emergency. The Switchyard Structures include the 345-kV switchyard, the switchyard relay house, and the switchyard maintenance building. The Switchyard Structures support connection between the offsite transmission network and the onsite distribution, including unit generators. The foundations within the 345-kV switchyard consist of reinforced concrete bearing on soil.

The switchyard relay house is a single-story above-grade masonry wall structure with reinforced concrete walls below grade supported on a reinforced concrete foundation slab on soil. The foundations and supports for four breakers located in the Switchyard Structures are relied on to provide physical support and the switchyard relay house provides physical support, shelter, and protection for components relied on to provide offsite power during SBO and fire safe shutdown, and are, therefore, in scope for license renewal. The remainder of the Switchyard Structures, including the switchyard maintenance building, are not in scope for license renewal.

The intended function of the Switchyard Structures within the scope of license renewal includes the following:

- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-11 identifies the Switchyard Structures components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-11.

2.4.11.2 Staff Evaluation

The staff reviewed LRA Section 2.4.11; UFSAR Sections 1.2, 8.1, 8.2, and 8.3; UFSAR Figures 8.1-1, 8.1-2, 8.1-3, and 8.1-4; UFSAR Appendix H; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.11.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Switchyard Structures SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.12 Tank Foundations and Dikes

2.4.12.1 Summary of Technical Information in the Application

LRA Section 2.4.12 states that the purpose of Tank Foundations and Dikes is to provide structural support, shelter, and protection for safety-related and nonsafety-related structure components and commodities, including systems and components that support fire safe shutdown. The purpose of the dikes around the cycled condensate storage tanks is for spill mitigation. Tank Foundations and Dikes consists of the cycled condensate storage tank foundations and dikes, clean condensate tank foundation, demineralized water tank foundation, well water storage tank foundation, and demineralized regenerative solution tank foundation. The cycled condensate storage tanks are supported by a circular reinforced concrete ring foundation pad with the tank bottom supported by a layer of clean sand on top of compacted structural backfill. The dike does not perform an intended function and is, therefore, not in scope for license renewal.

The intended function of Tank Foundations and Dikes within the scope of license renewal includes the following:

- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) (10 CFR 54.4(a)(3)).

LRA Table 2.4-12 identifies Tank Foundations and Dikes components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-12.

2.4.12.2 Staff Evaluation

The staff reviewed LRA Section 2.4.12; UFSAR Sections 1.2, 3.1, 4.6, 5.4, 6.1, and 9.2; UFSAR Table 3.2-1; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.12.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Tank Foundations and Dikes SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.13 Turbine Building

2.4.13.1 Summary of Technical Information in the Application

LRA Section 2.4.13 states that the purpose of the Turbine Building is to provide structural support, shelter, and protection for nonsafety-related SSCs during normal plant operation and certain safety-related system components during both normal operations and during and following the safe shutdown earthquake seismic event. The Turbine Building is a multiple-story structure comprised of a reinforced concrete substructure supported on a reinforced concrete mat foundation on soil with a steel frame above the grade floor. The two 210-ton overhead cranes, one for each unit, service the turbine generators. The Turbine Building contains steam and power conversion system components and the support systems and components necessary to support fire protection and SBO. The Turbine Building superstructure is designed to withstand tornado loads on the exposed structural frame to prevent collapse. The building is classified as a nonsafety-related seismic Category II structure. With some architectural exceptions, the Turbine Building is in scope for license renewal in its entirety.

The intended functions of the Turbine Building within the scope of license renewal include the following:

- Provide structural support or restraint to SSCs in the scope of license renewal (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of safety-related functions (10 CFR 54.4(a)(2)).
- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), EQ (10 CFR 50.49), and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-13 identifies the Turbine Building components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-13.

2.4.13.2 Staff Evaluation

The staff reviewed LRA Section 2.4.13; UFSAR Sections 1.1, 1.2, 2.4, 3.1, 3.3, 3.4, 7.7, 9.4, 11.2, and 12.3; UFSAR Appendix J; UFSAR Table 3.2-1; UFSAR Figure 2.5-51; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.13.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Turbine Building SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.4.14 Yard Structures

2.4.14.1 Summary of Technical Information in the Application

LRA Section 2.4.14 states that the purpose of Yard Structures is to provide structural support; shelter; and protection for nonsafety-related components and commodities, including components that supply power to safety-related equipment during emergency plant operating conditions and power to equipment relied on for post-fire safe shutdown or recovery from an SBO. Yard Structures include transformer foundations, trenches, light poles, transmission towers, fire hose storage foundations, manholes, valve pits, duct banks, yard drainage, miscellaneous yard structures, and the meteorological tower.

The intended function of the Yard Structures within the scope of license renewal includes the following:

- Provide physical support, shelter, and protection for SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63) (10 CFR 54.4(a)(3)).

LRA Table 2.4-14 identifies Yard Structures components within the scope of license renewal and subject to an AMR. The AMR results for these components are provided in LRA Table 3.5.2-14.

2.4.14.2 Staff Evaluation

The staff reviewed LRA Section 2.4.14; UFSAR Sections 1.2, 2.4, 3.1, 8.2, 9.1, and 9.5; UFSAR Table 3.2-1 and Table 8.3-5; and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4. The staff also reviewed UFSAR Section 3.8.4 to identify seismic Category I structures.

During its review, the staff evaluated the structure and component functions described in the LRA and UFSAR 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 being within the scope of license renewal to verify that it 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).

2.4.14.3 Conclusion

Based on the results of the staff's evaluation discussed in SER Section 2.4 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the Yard Structures SCs within the scope of license renewal as required by 10 CFR 54.4(a). The staff also concludes that the applicant adequately identified the components subject to an AMR in accordance with the requirements in 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical

This section documents the staff's review of the applicant's scoping and screening results for electrical systems. Specifically, this section discusses electrical components and commodity groups.

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 that 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, "Scope," components and supporting structures for electrical and I&C 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 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 UFSAR 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 SCs with intended functions, the staff sought to determine whether (1) the intended 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 SCs 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.

2.5.1 Electrical Systems

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5 describes the scoping and screening results for electrical systems. LSCS electrical systems were scoped per criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3). A bounding scoping approach was used for electrical equipment. All electrical components within in-scope systems were included within the scope of license renewal. The results of the electrical systems scoping review are provided in LRA Table 2.2-1, "Plant Level Scoping Results." In addition, electrical components, including certain switchyard components, credited to restore offsite power following an SBO are included within the scope of license renewal.

A bounding screening approach, as described in NEI 95-10 was used to assign electrical components in scope of license renewal to commodity groups. The commodities subject to an AMR were identified by applying the regulations at 10 CFR 54.21(a)(1)(i) and (ii). Electrical components in the SBO offsite power recovery path were identified based on their intended functions. A list of electrical components and commodities identified at LSCS is provided in LRA Section 2.5.2.1, "Identification of Electrical Commodities." The list includes electrical components and commodities identified in NEI 95-10 Appendix B in addition to components and commodities added per NUREG-1800 Table 2.1-5.

The criterion of 10 CFR 54.21(a)(1)(i) was then applied to identify components and commodities that perform license renewal functions, as described in 10 CFR 54.4, "Scope," without moving parts or without a change in configuration or properties (i.e., passive components). In the screening process, the following electrical commodities were determined not to have a license renewal intended function: cable tie wraps, fuse holders (not part of active equipment): metallic clamps, and uninsulated ground conductors. The fuse holder commodity includes both the insulation portion and the metallic clamp portion of the fuse holder. The insulation portion of the fuse holders was scoped as part of the "insulation material for electrical cables and connections" commodity. The metallic clamp portion of the fuse holders was scoped as a "fuse holder (not part of active equipment): metallic clamps" commodity.

The criterion of 10 CFR 54.21(a)(1)(ii) was applied to the electrical commodities that remained following application of the 10 CFR 50.21(a)(1)(i) criterion to exclude those commodities that are subject to replacement based on a qualified life or specified time period. The only electrical commodities identified for exclusion are electrical components and commodities included in the EQ Program. The remaining commodities (i.e., long-lived components), which are not in the EQ Program and which are not part of larger active components, require an AMR and are identified in LRA Table 2.5.2-1, "Electrical Commodities Subject to Aging Management Review," along with their associated license renewal intended functions as follows:

- Cable Connections (Metallic Parts) – electrical continuity
- High Voltage Insulators – insulate (electrical)
- Insulation Material for Electrical Cables and Connections – insulate (electrical)
- Metal Enclosed Bus – electrical continuity, insulate (electrical), and shelter, protection
- Switchyard Bus and Connections – electrical continuity
- Transmission Conductors – electrical continuity
- Transmission Connectors – electrical continuity

Components supporting or interfacing with electrical components are assessed in the appropriate mechanical or structures sections. Components, such as cable trays, conduits, instrument racks, panels and enclosures, structures associated with switchyard circuit breakers, and the switchyard relay house, are assessed in LRA Section 2.4, "Scoping and Screening Results: Structures and Component Supports." The shelter, protection, and pressure boundary intended functions of electrical penetrations are also addressed in LRA Section 2.4. Electrical components that have pressure boundary functions, such as elements, resistance temperature detectors, sensors, thermocouples, transducers, and electric heaters (housing), are addressed in the LRA Section 2.3, "Scoping and Screening Results: Mechanical."

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5; LRA Section 2.1.3.4, "Scoping for Regulated Events" (SBO); and LSCS UFSAR Chapter 8 using the evaluation methodology described in SRP-LR Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems."

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any electrical components with intended functions delineated under 10 CFR 54.4(a).

The regulation at 10 CFR 54.4(a)(3) requires that, all SSCs relied on in safety analyses or plant evaluation to perform a function that demonstrates compliance with NRC regulations for SBO (10 CFR 50.63), be included within the scope of license renewal. SRP-LR Section 2.5.2.1.1, "Components within the Scope of SBO (10 CFR 50.63)," provides the guidance to identify electrical systems components that are relied on to meet the requirements of the SBO rule for license renewal. This includes (1) the onsite power system meeting the requirements in 10 CFR 54.4 (a)(1) (safety-related systems), (2) equipment that is required to cope with an SBO (e.g., alternate AC power sources) meeting the requirements in 10 CFR 54.4(a)(3), and (3) the plant system portion of the offsite power system, including the electrical distribution equipment out to the first circuit breaker with the offsite distribution system (i.e., equipment in the switchyard), that is used to connect the plant to the offsite power source meeting the requirements in 10 CFR 54.4(a)(3).

In addition, General Design Criterion 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that electric power from the transmission network to the onsite electric distribution system is supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure.

The SSCs that are relied on to meet the requirements of the SBO rule in both circuits are to be included within the scope of licensee renewal. In LRA Section 2.1.3.4, the applicant provided the LSCS SBO recovery boundary in Figure 2.1-2, "LaSalle SBO Recovery Boundary," and components that are within the scope of license renewal on the plant side of the SBO boundaries.

LSCS satisfies the requirements of 10 CFR 50.63, "Loss of All Alternating Current Power," as an AC-independent 4-hour coping plant. As stated in UFSAR Section 15.9.3.2, the 125 volts direct current (VDC) (Divisions 1 and 2) and 250-VDC Class 1E batteries are sized to provide SBO loads for 4 hours. The Class 1E batteries and associated safety-related equipment are included within the scope of license renewal as required by 10 CFR 54.4(a)(1).

An SBO power recovery is defined as the repowering of the plant AC distribution system from offsite sources or onsite emergency AC sources. For LSCS, two physically independent circuits are provided for each unit, one through the unit's assigned system auxiliary transformer (SAT), and the other from the SAT of the other unit. The applicant included, within the scope of license renewal, the circuits between the Units 1 and 2 4,160-V engineered safety features buses up to and including the 345-kV circuit breakers supplying the SATs.

For Unit 1, as shown on LRA Figure 2.1-2, the circuits supplying power to the Divisions 1 and 2 engineered safety features buses 141Y (142Y) consist of (1) the normal circuit from the 345-kV switchyard circuit breakers 11-13 and 1-13 through the SAT 142 and circuit breakers 1412 (1422) and (2) the alternate circuit from the 345-kV switchyard circuit breakers 1-6 and 4-6 through the SAT 242 and circuit breakers 2412 (2422) through unit tie breakers 2414 and 1414 (2424 and 1424), respectively.

For Unit 2, as shown on LRA Figure 2.1-2, the circuits supplying power to the Divisions 1 and 2 engineered safety features buses 241Y (242Y) consist of (1) the normal circuit from the 345-kV switchyard circuit breakers 1-6 and 4-6 through the SAT 242 and circuit breakers 2412 (2422) and (2) the alternate circuit from the 345-kV switchyard circuit breakers 11-13 and 1-13 through the SAT 142 and circuit breaker 1412 (1422) through unit tie breakers 1414 and 2414 (1424 and 2424), respectively.

The switchyard bus and connections, control circuits and structures associated with the switchyard circuit breakers, the switchyard relay house, transmission conductors and connections, high-voltage insulators, and metal enclosed bus, within the SBO recovery boundaries are also included within the scope of license renewal. Components that are subject to an AMR are included in LRA Table 2.5.2-1. Based on the review of the SBO scoping information, the staff concludes that the scoping is consistent with the guidance in SRP-LR Section 2.5.2.1.1.

The staff then reviewed those electrical and I&C components and commodities that the applicant identified as being 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 include cable tie-wraps in the electrical commodity groups subject to an AMR because cable tie-wraps do not have a license renewal intended function at LSCS. The applicant stated that LSCS has no current license basis requirements that cable tie-wraps must remain functional during and following DBEs and that cable tie-wraps are not credited in the LSCS design basis in terms of any 10 CFR 54.4, "Scope," intended function. The applicant clarified that cable tie-wraps are used to bundle wires and cables together to keep the wire and cable runs neat and to restrain cables and wires to facilitate cable installation and maintenance at LSCS. Based on the review of this information and the LSCS UFSAR, the staff finds that the exclusion of cable tie-wraps from the electrical commodity groups subject to an AMR is acceptable.

The applicant did not include Fuse Holders (Not Part of Active Equipment): Metallic Clamps in the electrical commodities subject to an AMR because, based on a systematic review performed using plant documents, controlled drawings, and the plant equipment database, the metallic clamps portion of LSCS fuse holders were either installed in active equipment or did not perform a license renewal intended function. Based on the review of this information, the staff finds that the exclusion of Fuse Holders (Not Part of Active Equipment): Metallic Clamps from the electrical commodities subject to an AMR is acceptable.

The applicant did not include uninsulated ground conductors in the electrical commodity groups subject to an AMR because uninsulated ground conductors do not perform a license renewal intended function at LSCS. The applicant clarified that uninsulated ground conductors are provided for equipment and personnel protection. The staff reviewed the UFSAR and found that uninsulated ground conductors are not credited in the LSCS design basis. Therefore, the staff concludes that the exclusion of uninsulated ground conductors from the electrical commodity groups subject to an AMR is acceptable.

2.5.1.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. In addition, the staff's review 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 (1) the applicant's scoping and screening methodology was consistent with 10 CFR 54.21(a)(1) and the staff's positions on the treatment of safety-related and nonsafety-related SSCs within the scope of license renewal and (2) the applicant's determination of SCs subject to an AMR 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 that 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).

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 LaSalle County Station, Units 1 and 2 (LSCS), by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff).

In Appendix B to its license renewal application (LRA), as amended during the review, Exelon Generation Company, LLC (Exelon or the applicant), described the 46 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 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010. 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.

The staff's review was in accordance with Title 10 of the *Code of Federal Regulations*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" (10 CFR Part 54); the guidance in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated December 2010; and the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMPs during the weeks of March 30, 2015, and April 13, 2015. The onsite audits are 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 is structured in accordance with Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," Revision 1, dated September 2005, and Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Revision 6, dated June 2005. 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 1's: 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 2's: 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.

In its Table 1's, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2's, 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 1's

Each Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables in the GALL Report. The tables are essentially the same as summary Tables 3.1-1 through 3.6-1 in the SRP-LR, except that the "ID" column is named "Item Number," the "Type" column has been deleted because it is not necessary, and the "Rev2 Item" and "Rev1 Item" columns have been replaced by a "Discussion" column. The "Item Number" column is a means for the staff reviewer to cross-reference Table 2's with Table 1's. 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 item is consistent with the corresponding item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding 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 SRP-LR table row so that consistency can be checked easily.

3.0.1.2 Overview of Table 2's

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 Vessel, Internals, and Reactor Coolant System; Engineered Safety Features; Auxiliary Systems). For example, the Reactor Vessel, Internals and Reactor Coolant System group has tables specific to the Reactor Coolant Pressure Boundary System (Table 3.1.2–1), the Reactor Vessel (Table 3.1.2–2), and the Reactor Vessel Internals System (Table 3.1.2–3). 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 2.1-1.

(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 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.

(8) Table 1 Item – The eighth column lists the corresponding summary item number from the LRA Table 1's. If the applicant identifies in each LRA Table 2 AMR results consistent with the GALL Report, the Table 1 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 working group and will be used in future LRAs. Any plant-specific notes identified by numbers provide additional information about the consistency of the 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 are 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 are 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 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 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 before 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.

The staff's 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, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

3.0.2.1 Review of Aging Management Programs

For 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 exceptions, the staff evaluated each exception to determine whether the exception was acceptable and whether the modified AMP would adequately manage the aging effect(s) for which it was credited. For AMPs that were 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 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/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 timely.

(8) Confirmation Process – Confirmation process should ensure that preventive actions are adequate and that appropriate 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 and 10 are documented in SER Section 3.0.3.

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 Sections 3.0.3 and 3.0.5.

3.0.2.2 Review of AMR Results

Each LRA Table 2 contains information concerning whether 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. 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. 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 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 item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR 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 audited these items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR 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 audited these 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 item, although different from that in the GALL Report, is consistent with that in 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 a listing of some system components 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 audited these items to verify consistency with the GALL Report. The staff also determined whether the AMR 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 item, although different from that in the GALL Report, is consistent with that in the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these items to verify consistency with the GALL Report. The staff verified whether the AMR 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 item is consistent with the GALL Report for material, environment, and aging effect but credits a different AMP. The staff audited these 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 UFSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the updated final safety analysis report (UFSAR) 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, 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.

3.0.3 Aging Management Programs

SER Table 3.0-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates 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 3.0-1 LSCS Aging Management Programs

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	A.2.1.1 B.2.1.1	Existing	Consistent	XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	3.0.3.1.1 *(Consistent)*
Water Chemistry	A.2.1.2 B.2.1.2	Existing	Consistent with Exception	XI.M2, "Water Chemistry"	3.0.3.2.1 *(Consistent with Exception)*
Reactor Head Closure Stud Bolting	A.2.1.3 B.2.1.3	Existing	Consistent with Exceptions	XI.M3, "Reactor Head Closure Stud Bolting"	3.0.3.2.2 *(Consistent with Exceptions)*
BWR Vessel ID Attachment Welds	A.2.1.4 B.2.1.4	Existing	Consistent	XI.M4, "BWR Vessel ID Attachment Welds"	3.0.3.1.2 *(Consistent)*
BWR Feedwater Nozzle	A.2.1.5 B.2.1.5	Existing	Consistent	XI.M5, "BWR Feedwater Nozzle"	3.0.3.1.3 *(Consistent)*
BWR Control Rod Drive Return Line Nozzle	A.2.1.6 B.2.1.6	Existing	Consistent	XI.M6, "BWR Control Rod Drive Return Line Nozzle"	3.0.3.1.4 *(Consistent)*
BWR Stress Corrosion Cracking	A.2.1.7 B.2.1.7	Existing	Consistent	XI.M7, "BWR Stress Corrosion Cracking"	3.0.3.1.5 *(Consistent)*
BWR Penetrations	A.2.1.8 B.2.1.8	Existing	Consistent	XI.M8, "BWR Penetrations"	3.0.3.1.6 *(Consistent)*
BWR Vessel Internals	A.2.1.9 B.2.1.9	Existing	Consistent with Enhancements	XI.M9, "BWR Vessel Internals"	3.0.3.2.3 *(Consistent with Enhancements)*
Flow-Accelerated Corrosion	A.2.1.10 B.2.1.10	Existing	Consistent	XI.M17, "Flow-Accelerated Corrosion"	3.0.3.1.7 *(Consistent with Exception)*
Bolting Integrity	A.2.1.11 B.2.1.11	Existing	Consistent with Enhancements	XI.M18, "Bolting Integrity"	3.0.3.2.4 *(Consistent with Enhancements)*
Open-Cycle Cooling Water System	A.2.1.12 B.2.1.12	Existing	Consistent with Enhancements	XI.M20, "Open-Cycle Cooling Water System"	3.0.3.2.5 *(Consistent with Enhancements)*
Closed Treated Water Systems	A.2.1.13 B.2.1.13	Existing	Consistent with Enhancement	XI.M21A, "Closed Treated Water Systems"	3.0.3.2.6 *(Consistent with Enhancements)*
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	A.2.1.14 B.2.1.14	Existing	Consistent with Enhancement	XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	3.0.3.2.7 *(Consistent with Enhancement)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Compressed Air Monitoring	A.2.1.15 B.2.1.15	Existing	Consistent with Exception and Enhancements	XI.M24, “Compressed Air Monitoring”	3.0.3.2.8 *(Consistent with Exception and Enhancements)*
Fire Protection	A.2.1.16 B.2.1.16	Existing	Consistent with Enhancements	XI.M26, “Fire Protection”	3.0.3.2.9 *(Consistent with Enhancements)*
Fire Water System	A.2.1.17 B.2.1.17	Existing	Consistent with Exceptions and Enhancements	XI.M27, “Fire Water System”	3.0.3.2.10 *(Consistent with Exceptions and Enhancements)*
Aboveground Metallic Tanks	A.2.1.18 B.2.1.18	Existing	Consistent with Enhancements	XI.M29, “Aboveground Metallic Tanks”	3.0.3.2.11 *(Consistent with Enhancements)*
Fuel Oil Chemistry	A.2.1.19 B.2.1.19	Existing	Consistent with Enhancements	XI.M30, “Fuel Oil Chemistry”	3.0.3.2.12 *(Consistent with Enhancements)*
Reactor Vessel Surveillance	A.2.1.20 B.2.1.20	Existing	Consistent	XI.M31, “Reactor Vessel Surveillance”	3.0.3.1.8 *(Consistent with Exception and Enhancements)*
One-Time Inspection	A.2.1.21 B.2.1.21	New	Consistent	XI.M32, “One-Time Inspection”	3.0.3.1.9 *(Consistent)*
Selective Leaching	A.2.1.22 B.2.1.22	New	Consistent	XI.M33, “Selective Leaching”	3.0.3.1.10 *(Consistent)*
Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping	A.2.1.23 B.2.1.23	New	Consistent	XI.M35, “One-time Inspection of ASME Code Class 1 Small Bore-Piping”	3.0.3.1.11 *(Consistent)*
External Surfaces Monitoring of Mechanical Components	A.2.1.24 B.2.1.24	New	Consistent	XI.M36, “External Surfaces Monitoring of Mechanical Components”	3.0.3.1.12 *(Consistent)*
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	A.2.1.25 B.2.1.25	New	Consistent	XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	3.0.3.1.13 *(Consistent)*
Lubricating Oil Analysis	A.2.1.26 B.2.1.26	Existing	Consistent	XI.M39, “Lubricating Oil Analysis”	3.0.3.1.14 *(Consistent)*
Monitoring of Neutron-Absorbing Materials Other Than Boraflex	A.2.1.27 B.2.1.27	Existing	Consistent with Enhancement	XI.M40, “Monitoring of Neutron-Absorbing Materials Other than Boraflex”	3.0.3.2.13 *(Consistent with Enhancement)*
Buried and Underground Piping	A.2.1.28 B.2.1.28	Existing	Consistent with Enhancements	XI.M41, “Buried and Underground Piping and Tanks”	3.0.3.2.14 *(Consistent with Enhancements)*
ASME Section XI, Subsection IWE	A.2.1.29 B.2.1.29	Existing	Consistent with Enhancements	XI.S1, “ASME Section XI, Subsection IWE”	3.0.3.2.15 *(Consistent with Enhancements)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
ASME Section XI, Subsection IWL	A.2.1.30 B.2.1.30	Existing	Consistent with Enhancements	XI.S2, “ASME Section XI, Subsection IWL”	3.0.3.2.16 *(Consistent with Enhancements)*
ASME Section XI, Subsection IWF	A.2.1.31 B.2.1.31	Existing	Consistent with Enhancements	XI.S3, “ASME Section XI, Subsection IWF”	3.0.3.2.17 *(Consistent with Enhancements)*
10 CFR Part 50, Appendix J	A.2.1.32 B.2.1.32	Existing	Consistent	XI.S4, “10 CFR Part 50, Appendix J”	3.0.3.1.15 *(Consistent)*
Masonry Walls	A.2.1.33 B.2.1.33	Existing	Consistent with Enhancements	XI.S5, “Masonry Walls”	3.0.3.2.18 *(Consistent with Enhancements)*
Structures Monitoring	A.2.1.34 B.2.1.34	Existing	Consistent with Enhancements	XI.S6, “Structures Monitoring”	3.0.3.2.19 *(Consistent with Enhancements)*
RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	A.2.1.35 B.2.1.35	Existing	Consistent with Enhancements	XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants”	3.0.3.2.20 *(Consistent with Enhancements)*
Protective Coating Monitoring and Maintenance Program	A.2.1.36 B.2.1.36	Existing	Consistent	XI.S8, “Protective Coating Monitoring and Maintenance Program”	3.0.3.1.16 *(Consistent)*
Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.37 B.2.1.37	New	Consistent	XI.E1, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.17 *(Consistent)*
Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	A.2.1.38 B.2.1.38	New	Consistent	XI.E2, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits”	3.0.3.1.18 *(Consistent)*
Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.39 B.2.1.39	New	Consistent	XI.E3, “Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.19 *(Consistent)*
Metal Enclosed Bus	A.2.1.40 B.2.1.40	Existing	Consistent with Enhancements	XI.E4, “Metal-Enclosed Bus”	3.0.3.2.21 *(Consistent with Enhancements)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	A.2.1.41 B.2.1.41	New	Consistent	XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.20 *(Consistent)*
Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program	A.2.2.1 B.2.2.1	New	Plant-Specific	XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	3.0.3.3.1 *Plant Specific*
Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program	A.2.2.2 B.2.2.2	New	Plant-Specific	N/A	3.0.3.3.2 *Plant Specific*
Fatigue Monitoring	A.3.1.1 B.3.1.1	Existing	Consistent with Enhancements	X.M1, “Fatigue Monitoring”	3.0.3.2.22 *(Consistent with Enhancements)*
Concrete Containment Tendon Prestress	A.3.1.2 B.3.1.2	Existing	Consistent with Enhancement	X.S1, “Concrete Containment Tendon Prestress”	3.0.3.2.23 *(Consistent with Enhancement)*
Environmental Qualification (EQ) of Electric Components	A.3.1.3 B.3.1.3	Existing	Consistent	X.E1, “Environmental Qualification (EQ) of Electrical Components”	3.0.3.1.21 *(Consistent)*

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
- BWR Vessel ID Attachment Welds
- BWR Feedwater Nozzle
- BWR Control Rod Drive Return Line Nozzle
- BWR Stress Corrosion Cracking
- BWR Penetrations
- Flow-Accelerated Corrosion
- Reactor Vessel Surveillance
- One-Time Inspection
- Selective Leaching
- Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping
- External Surfaces Monitoring of Mechanical Components

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- 10 CFR Part 50, Appendix J
- Protective Coating Monitoring and Maintenance Program
- Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Environmental Qualification (EQ) of Electric Components

3.0.3.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

Summary of Technical Information in the Application. LRA Section B.2.1.1 describes the applicant's existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, as consistent with GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The LRA states that the program manages cracking and loss of fracture toughness for American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 piping and components exposed to reactor coolant environment. The LRA also states that the program includes periodic visual, surface, and volumetric examinations of ASME Code Class 1, 2, and 3 piping and components. The LRA further states that the program performs these examinations in accordance with ASME Code Section XI ISI, Subsections IWB, IWC, and IWD.

In addition, the LRA states that currently the program is in its third 10-year inspection interval, using the 2001 Edition through 2003 Addenda of the ASME Code and Risk-Informed Inservice Inspection (RI-ISI) alternatives for examination categories B-F, B-J, C-F-1, and C-F-2 for ASME Code Class 1 and 2 piping welds (as approved by relief request). The LRA further states that the program is updated every 10-year inspection interval to the latest ASME Code Edition and Addenda approved by the NRC in 10 CFR 50.55a, 12 months before the start of the interval. The LRA states that the program is consistent with the program described in the GALL Report, Section XI.M1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M1. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M1.

Operating Experience. LRA Section B.2.1.1 summarizes operating experience related to the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program. LRA states that in 2004, Unit 1 core spray piping welds internal to the reactor vessel were inspected using ultrasonic test (UT) examinations. The applicant stated that, as a result of these examinations, three welds were determined to have five indications. The applicant also stated that these indications were evaluated as acceptable for one operating cycle; re-examinations in 2006 did not reveal any changes. The applicant further stated that subsequent examinations in 2008 determined that the indications in two of the welds were geometric reflections. The applicant stated that the remaining weld was examined again in 2012 with no notable changes to the indication and was determined to be acceptable for two additional operating cycles by evaluation. The applicant stated that the core spray piping welds for Unit 2 have also been inspected by volumetric examination with no recorded indications.

The applicant stated that, in 2005, surface examinations performed on Unit 2 using magnetic particle examinations revealed several indications, which did not meet the acceptance criteria of ASME Code Section XI, Subsections IWC-3500 and IWB-3500. The applicant also stated that the indications, which were in pipe base metal (near a lug weld), were completely removed as part of its corrective actions. The applicant further stated that subsequent to flaw removal, volumetric examination was performed to verify acceptable pipe wall thickness.

The applicant stated that the program is informed by plant-specific and industry operating experience and that it is enhanced as needed. The applicant also stated that there is confidence that the program will continue to be effectively implemented and that it will continue to identify degradation before failure and loss of intended function during the period of extended operation.

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. 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 evaluated and incorporated operating experience related to this program.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M1 was evaluated.

UFSAR Supplement. LRA Section A.2.1.1 provides the UFSAR supplement for the ASME Section XI ISI, Subsections IWB, IWC, and IWD program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing ASME Section XI ISI, Subsections IWB, IWC, and IWD program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI ISI, Subsections IWB, IWC, and IWD program, the staff concludes 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 UFSAR 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 BWR Vessel ID Attachment Welds

Summary of Technical Information in the Application. LRA Section B.2.1.4 describes the applicant's existing BWR Vessel ID Attachment Welds program as a condition monitoring program consistent with GALL Report AMP XI.M4, "BWR Vessel ID Attachment Welds." The LRA states that the program performs condition monitoring by in-vessel examinations through the station's augmented inservice inspections. The inspections are performed in accordance with the guidelines of Boiling Water Reactor Vessel and Internals Project (BWRVIP)-48-A, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines." Any detected indications are evaluated in accordance with ASME Code Section XI, Subsections IWB-3500 and IWB-3600, and with the additional guidance provided by BWRVIP-48-A. The program includes the vessel attachment welds for the following internal components: steam dryer support and hold down bracket, guide rod bracket, feedwater sparger bracket, jet pump riser brace, core spray piping bracket, and surveillance sample holder bracket. In conjunction with this program, the Water Chemistry program is also used to mitigate the aging effect of cracking of reactor vessel internal attachment welds exposed to reactor coolant by maintaining high reactor coolant purity.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M4. Based on its audit, the staff found that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M4. However, as a result of the NRC's license renewal inspection at LSCS, completed on October 16, 2015, the staff identified a potential issue related to the effective coverage obtained in the performance of qualified enhanced visual examinations (EVT-1s) for LSCS's vessel internals.

The staff noted that Exelon Procedure ER-AB-331, Revision 14, "BWR Internals Program Management," addresses changes to the EVT-1 requirements in BWRVIP-03, "Reactor Pressure Vessel and Internals Examination Requirements." Attachment 1 to ER-AB-331, "Exelon Position on EVT-1 Implementation," states that changes related to the reduction of the allowable viewing angle have reduced the effective coverage of some weld examinations to zero percent in some cases. It further states that "EVT-1 inspections of required welds and components that yield an effective coverage of zero percent meet the BWRVIP inspection requirements." The staff noted that ER-AB-331 is an implementation document for the BWR Vessel ID Attachment Welds and the BWR Vessel Internals AMPs.

Although not addressed in BWRVIP guidelines, the staff's expectation is that the examination coverage of inspections performed for AMPs based on BWRVIP guidance would be in accordance with the ASME Code. Since BWRVIP-03 and BWRVIP-48-A do not address minimum required effective examination coverage, it is unclear to the staff whether limited examination coverage meets the BWRVIP's expected level of implementation. The staff had identified this issue as open item OI 3.0.3.1.2-1.

By letter dated February 16, 2016, the staff issued RAI B.2.1.4-1, requesting the applicant to: (1) provide a summary of the locations where EVT-1 examinations are performed, whether Alloy 182 welds are included, and the percent coverage for these examinations; (2) provide the technical basis regarding the limited inspection coverage, and its adequacy to detect aging degradation prior to loss of intended function(s) where examination coverage is expected to be less than 90 percent; (3) provide a summary of the operating experience related to detected flaws, and the results of any flaw analyses; (4) describe how inspection results with minimal coverage will be documented and justified during the period of extended operation; and (5) state whether deviation reports will be submitted for inspection results for vessel attachment welds that credit examinations with limited coverage and if not, justify how the BWRVIP will provide adequate oversight of the effectiveness of the BWR Vessel ID Attachment Welds.

By letter dated February 25, 2016, the applicant provided its response to RAI B.2.1.4-1. For Part 1 of the RAI, the applicant provided a summary of the EVT-1 examinations performed on vessel ID attachment welds for LSCS, from 2004 through 2015. Based on a review of available records, the applicant concluded that most of the attachment welds subject to EVT-1 examinations are at least partially fabricated with Alloy 182 material, which is susceptible to intergranular stress corrosion cracking (IGSCC). The applicant explained that at the time of the inspections, examinations were performed according to the latest revision of BWRVIP-03. The applicant stated that BWRVIP-03, Revision 10, required that the angle of inspection not exceed 30 degrees from perpendicular to the examination surface to meet the qualification requirements of EVT-1. The applicant also stated that prior to this revision, the inspection angle could be as much as 60 degrees, similar to what is required for VT-1 examinations performed for ASME Code, Section XI. The applicant further stated that this revision to the EVT-1 examination was implemented at LSCS, Unit 2, during the refueling outage in 2009 and for Unit 1 during the 2010 outage. The applicant stated that the average EVT-1 examination coverage for the attachment welds prior to this revision was 91 percent for Unit 1, and 87 percent for Unit 2, and the average EVT-1 examination coverage for the attachment welds after the revision is 72 percent for Unit 1, and 66 percent for Unit 2.

The applicant explained that it performs an examination on the entire accessible surface of the vessel ID attachment weld, and the reported coverage is calculated using the total accessible weld examined that meets the EVT-1 requirements and the entire weld (i.e., accessible plus inaccessible). The applicant stated that the portions that cannot be examined to the EVT-1 requirements are visually examined by a qualified nondestructive examination specialist.

In response to Part 2 of the RAI, the applicant stated that if the qualification requirements remain the same during the period of extended operation, it expects examination coverage would be consistent with what is currently achieved, as reported in its response to Part 1 of the RAI. The applicant stated that while BWRVIP-48-A does not address required examination coverage for attachment welds, the examination methods that are applicable (BWRVIP-03, Revision 18) direct that all accessible surfaces of the component be examined. For welds this is further defined to include the adjacent base metal.

The applicant stated that the ASME Code Section XI, requires examinations of accessible attachment welds using either VT-1 or VT-3 methods, whereas the examination method used for certain vessel attachment welds (EVT-1) is more effective in the detection of cracks characteristic of IGSCC. The applicant also stated that while some of the reported vessel ID attachment welds have limited EVT-1 coverage (i.e., less than 90 percent of the entire weld surface), it is adequate to detect aging degradation prior to loss of intended function. The applicant further stated that the EVT-1 method is the nuclear industry standard for visual examination, and is more effective than the ASME Code Section XI requirement for vessel ID attachment welds.

In response to Part 3 of the RAI, the applicant stated that it has not detected indications of cracking on the vessel ID attachment welds for LSCS; therefore, it has not performed any evaluations or flaw analyses to determine the maximum flaw size that can be tolerated. The applicant also stated that there have not been any reported instances of IGSCC in vessel attachment welds for the domestic BWR fleet. The applicant stated that if a flaw was detected and it did not meet the standards for ASME Section XI, IWB-3520, the flaw would be analytically evaluated in accordance with ASME Section XI, IWB-3600, for acceptability, and these evaluations include determination of the maximum allowable flaw size.

In its response to Part 4 of the RAI, the applicant stated that based on its operating experience it does not expect EVT-1 examinations of vessel attachment welds with essentially zero-percent coverage would occur during the period of extended operation. The applicant stated that it has revised its procedure referenced in ER-AB-331, which discussed the possibility of accepting zero-percent EVT-1 examination coverage. The applicant also stated that the revised procedure requires that when the EVT-1 or VT-1 method is specified, the entire accessible surface of the weld or component is to be visually examined to the maximum extent practical with the specific qualification requirements. The applicant further stated that the procedure has been revised to clarify that in cases in which an EVT-1 examination of a reactor internal component results in zero-percent examination coverage, this condition is to be entered into the corrective action program and evaluated for whether a BWRVIP deviation report is required. The applicant reiterated that, based on historical data, it does not expect that essentially zero-percent EVT-1 examination coverage would occur for the vessel ID attachment welds during the period of extended operation.

In its response to Part 5 of the RAI, the applicant stated that Exelon implementing procedures require that it submit a deviation report to the BWRVIP when a mandatory or needed element is not being implemented consistent with the intent of the BWRVIP guidance. The applicant also stated that the BWRVIP provides for oversight of the effectiveness of the BWR Vessel ID Attachment Welds AMP through the use of reviews by the Institute of Nuclear Power Operations (INPO), which include comprehensive periodic onsite assessments of program implementation, monitoring, and review and analysis of operating experience. The applicant further stated that the results of these examinations are provided to the BWRVIP following each refueling outage.

The staff reviewed the applicant’s response and finds it acceptable because the applicant’s summary of past EVT-1 examinations, performed in accordance with BWRVIP-48-A and BWRVIP-03 for LSCS, confirmed that the EVT-1 examinations performed for the vessel ID attachment welds provide a level of examination equivalent to or superior to those that would have been expected if the examinations had been performed to the requirements of ASME Code Section XI, Subsection IWB, Examination Category B-N-2. Additionally, the applicant confirmed that there have not been any instances of crediting zero-percent examination coverage, and going forward its procedures will be revised to require that, in the unlikely event that zero-percent coverage is obtained, this condition would be entered into the corrective action program and evaluated for whether a BWRVIP deviation report is required. The staff’s concerns described in RAI B.2.1.4-1 are resolved, and the associated open item, OI 3.0.3.1.2-1, is closed.

Based on its audit and review of the applicant’s response to RAI B.2.1.4-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M4.

Operating Experience. LRA Section B.2.1.4 summarizes operating experience related to the applicant's BWR Vessel ID Attachment Welds program. The applicant stated that vessel ID attachment welds for Unit 1 were examined using a visual examination technique (i.e., EVT-1) during refueling outages (RFOs) in 2004, 2006, 2008, 2010, and 2012. The applicant also stated that the examinations included the attachment welds for the following vessel internal components: the jet pump riser brace support pads, feedwater sparger, steam dryer support bracket, and core spray piping bracket. The applicant further stated that these examinations did not identify any indications of cracking. In addition, the applicant indicated that similar examinations were performed for Unit 2 during the RFOs in 2005, 2007, 2011, and 2013. The applicant stated that these examinations did not identify any indications of cracking.

The applicant stated that the cited inspections provide a good example of how the program uses condition monitoring to manage the effects of cracking for the vessel internal attachment welds. The applicant further stated that the lack of cracking indications on its vessel attachment welds can be attributed to the effectiveness of the water chemistry management, design, and good installation practices. The applicant stated that, based on the program's effectiveness, there is reasonable assurance that the continued implementation of the BWR Vessel ID Attachment Welds program will identify degradation of vessel attachment welds before failure or loss of intended function during the period of extended operation.

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. 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 evaluated and incorporated operating experience related to this program.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which the GALL Report AMP XI.M4 was evaluated.

UFSAR Supplement. LRA Section A.2.1.4 provides the UFSAR supplement for the BWR Vessel ID Attachment Welds program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing BWR Vessel ID Attachment Welds program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and its review of the applicant's BWR Vessel ID Attachment Welds program, the staff concludes 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 UFSAR 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 BWR Feedwater Nozzle

Summary of Technical Information in the Application. LRA Section B.2.1.5 describes the existing BWR Feedwater Nozzle program as consistent with GALL Report AMP XI.M5, "BWR Feedwater Nozzle." The LRA states that the program is a condition monitoring program intended to manage the aging effect of cracking in the feedwater nozzles of the reactor vessel. The program manages these aging effects in accordance with ASME Code Section XI, Subsection IWB, Table IWB–2500–1, and with recommendations in BWR Owners Group Licensing Topical Report GE-NE-523-A71-0594-A, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirements," dated May 2000. According to the LRA, the applicant implements this program through the plant's ISI program and specifies a UT examination of critical regions of the feedwater nozzles. The LRA states that the applicant made changes to the nozzle design in response to NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," dated November 1980, to mitigate thermally induced fatigue cracking; that the design does not include cladding on the nozzle inner surface; and that the nozzle uses a triple sleeve design. A low-flow feedwater control valve is used, and the reactor water cleanup system returns flow to both feedwater loops to minimize the frequency and magnitude of temperature fluctuations and resulting thermal fatigue of the feedwater nozzles. The LRA also states that both units do not have a thermal sleeve bypass leakage detection system and that the inspection interval has not been modified based on leakage data. ASME Code Section XI criteria are used to evaluate flaws and inspection results that do not satisfy the acceptance standards are documented in accordance with the corrective action program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M5. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M5.

Operating Experience. LRA Section B.2.1.5 summarizes operating experience related to the BWR Feedwater Nozzle program. The LRA states that the applicant inspected each feedwater nozzle at least twice in accordance with the guidance in GE-NE-523-A71-0594-A, Revision 1, as part of the existing augmented ISI program. During the inspection of Units 1 and 2 feedwater nozzles in 2012 and 2011, respectively, the applicant discovered minor recordable indications evaluated as acceptable, consistent with ASME Code Section XI Article IWB-3000 criteria. Additionally, ISI reactor coolant boundary leakage testing performed during each RFO has not identified any leakage from the feedwater nozzles to date.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M5 was evaluated.

UFSAR Supplement. LRA Section A.2.1.5 provides the UFSAR supplement for the BWR Feedwater Nozzle program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing BWR Feedwater Nozzle program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Feedwater Nozzle program, the staff concludes 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 UFSAR 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 BWR Control Rod Drive Return Line Nozzle

Summary of Technical Information in the Application. LRA Section B.2.1.6 describes the existing BWR Control Rod Drive Return Line Nozzle program as consistent with GALL Report AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The LRA states that the AMP is a condition monitoring program that addresses the control rod drive return line (CRDRL) nozzle, which is exposed to a reactor coolant environment, to manage the effect of cracking. The LRA also states that the AMP proposes to manage this aging effect through periodic ISI examinations that are implemented in accordance with ASME Code Section XI, Table IWB-2500-1. The LRA further states that requirements of NUREG-0619 were implemented by capping the CRDRL nozzle and removing the return line. There are no ongoing maintenance or testing activities from NUREG-0619 that apply to LSCS, Units 1 and 2.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M6. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M6.

Operating Experience. LRA Section B.2.1.6 summarizes operating experience related to the BWR Control Rod Drive Return Line Nozzle program. The LRA states that the most recent UT examinations of the CRDRL nozzle blend radius, nozzle-to-vessel weld, and nozzle-to-cap weld performed on LSCS, Units 1 and 2, did not identify indications of cracking. Additionally, visual inspections (VT-2) of the CRDRL nozzle, cap, and associated welds have not discovered leakage. The VT-2 visual inspections are performed, as part of the ISI program, at each RFO during reactor pressure testing. The LRA also states that the Mechanical Stress Improvement Process (MSIP) was performed on the CRDRL nozzle-to-cap weld on LSCS, Units 1 and 2, to provide improved IGSCC resistance at the welds. Indications of cracks have not been discovered in these welds.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M6 was evaluated.

UFSAR Supplement. LRA Section A.2.1.6 provides the UFSAR supplement for the BWR Control Rod Drive Return Line Nozzle program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 6) to ongoing implementation of the existing BWR Control Rod Drive Return Line Nozzle program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Control Rod Drive Return Line Nozzle program, the staff concludes 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 UFSAR 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 BWR Stress Corrosion Cracking

Summary of Technical Information in the Application. LRA Section B.2.1.7 describes the existing BWR Stress Corrosion Cracking program as consistent with GALL Report AMP XI.M7, "BWR Stress Corrosion Cracking." The program is a condition monitoring and mitigative program that has been implemented in accordance with NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," dated January 1988, and NRC Generic Letter (GL) 88-01, "NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, and its Supplement 1, dated February 4, 1992. The program manages IGSCC in relevant piping and piping welds made of stainless steel and nickel-based alloy in reactor coolant and treated water environments. The program includes an induction heating stress improvement or mechanical stress improvement process to mitigate cracking on the welds susceptible to IGSCC. Reactor coolant water chemistry is controlled and monitored in accordance with Electric Power Research Institute (EPRI) guidelines to maintain high water purity and reduce susceptibility to SCC as described in LRA Section B.2.1.2, Water Chemistry program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M7. For the "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of the RAIs discussed below.

GALL Report AMP XI.M7 states that the program to manage IGSCC in reactor coolant pressure boundary piping is delineated in NUREG-0313, Revision 2, and GL 88-01 with its Supplement 1. The "detection of aging effects" program element of GALL Report AMP XI.M7 also states that modifications of the extent and schedule of inspection in GL 88-01 are allowed in accordance with the inspection guidance in staff-approved BWRVIP-75-A, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules."

LRA Section B.2.1.7 states that the BWR Stress Corrosion Cracking program is consistent with GALL Report AMP XI.M7. The LRA also states that hydrogen water chemistry and noble metals chemical addition have been implemented to further reduce the susceptibility of reactor coolant piping systems to IGSCC. The LRA further states that welds classified as Category A (IGSCC-resistant material) are subsumed into the Risk-Informed Inservice Inspection (RI-ISI) program in accordance with staff-approved EPRI Topical Report (TR)-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," dated December 1999.

During the audit, the staff noted that LSCS implemented RI-ISI for the current (third) ISI interval through the relief request process as approved by the NRC in its letter dated April 29, 2008. The staff also noted that the inspection extent for Category A welds, which are subsumed in the RI-ISI program, may not be consistent with the guidance in GALL Report AMP XI.M7 because the RI-ISI adopts a risk-based selection process. Therefore, the staff needed additional information to confirm whether the program will adequately manage cracking due to IGSCC for Category A welds during the period of extended operation.

By letter dated May 29, 2015, the staff issued RAI B.2.1.7-1 requesting that the applicant clarify whether the inspection extent for Category A welds, subsumed in the RI-ISI, is consistent with the guidance in GL 88-01 and BWRVIP-75-A. The staff also requested if the inspection extent for Category A welds is different from the guidance in GL 88-01 and BWRVIP-75-A, that the applicant clarify why the inspection extent for Category A welds is not identified as a program exception and provide the bases, with plant-specific operating experience, to show that the program adequately manages IGSCC for Category A welds.

In its response dated June 25, 2015, the applicant stated that the RI-ISI methodology approved and implemented for the third ISI interval (October 2007 – September 2017) is consistent with the guidance in staff-approved EPRI TR-112657, Revision B-A. The applicant also confirmed that, if such approval allowing implementation of risk-informed inspection per EPRI TR-112657, Revision B-A is not granted for the period of extended operation, LSCS will inspect Category A welds in accordance with the extent and frequency of inspection specified by BWRVIP-75-A, Table 3-1. The staff noted that BWRVIP-75-A, Table 3-1, specifies that the inspection extent for Category A welds be 25 percent under normal water chemistry or 10 percent under hydrogen water chemistry.

In addition, the applicant stated that all of the Category A welds are assigned medium-risk Category 4 except for two Unit 2 welds that are high-risk Category 2 welds. The applicant stated that its risk-informed inspection requires inspections of 25 percent of the high-risk Category 2 welds and 10 percent of the medium-risk Category 4 welds during each 10-year inspection interval in accordance with EPRI TR-112657, Revision B-A. As an example, the applicant stated that during the 10-year period of 2003 through 2012 there were five Category A welds (12 percent) inspected at Unit 1 and five Category A welds (9 percent) inspected at Unit 2. The applicant also indicated that, because the populations of Category 2 and Category 4 welds include many welds that are not included in the scope of the BWR Stress Corrosion Cracking program, the percentage of Category A welds selected for the risk-informed inspection may be more than, less than, or equal to the inspection extent specified in BWRVIP-75-A.

In its response regarding the program exception, the applicant indicated that the inspection extent for Category A welds is not identified as a program exception because the inspection extent for Category A welds will be consistent with BWRVIP-75-A and GALL Report AMP XI.M7 without obtaining NRC approval for continued use of RI-ISI during the period of extended operation.

The applicant also stated that EPRI TR-112657, Revision B-A, provides a staff-approved method for meeting GL 88-01 commitments for establishing the inspection extent for Category A welds. The applicant further stated that the introduction section of the NRC safety evaluation (SE) (October 28, 1999) for EPRI TR-112657, Revision B-A, states that RI-ISI programs enhance overall safety by (1) focusing inspections of piping at highly risk-significant locations and at locations where failure mechanisms are likely to be present and (2) improving the effectiveness of inspection of components because examination methods are based on the postulated failure mode and configuration of the piping structural element.

In its response regarding operating experience, the applicant stated that there has never been a leak or an indication identified from an inspection that was indicative of IGSCC for any welds within the scope of the program at LSCS, Units 1 and 2, and this demonstrates that the Water Chemistry program, materials selection, and implementation of processes and programs providing resistance to IGSCC have been effectively implemented at LSCS. The applicant also stated that continuing to subsume the Category A welds into the RI-ISI program in accordance with EPRI TR-112657, Revision B-A, results in an adequate methodology to manage the aging effect of IGSCC for Category A welds.

In its review, the staff found the applicant’s response acceptable because (1) the applicant clarified that its currently approved and implemented RI-ISI program for the third 10-year interval is consistent with the staff-approved guidance for inspections of Category A welds described in EPRI TR-112657, Revision B-A, (2) the applicant confirmed that it will inspect Category A welds in accordance with the guidance in BWRVIP-75-A for the period of extended operation if RI-ISI is not granted, and (3) the applicant confirmed that there was no leak or inspection result that indicates occurrence of IGSCC in any welds within the scope of the program. The staff’s concern described in RAI B.2.1.7-1 is resolved.

As defined in GL 88-01, Category B and C welds are made of materials that are nonresistant to IGSCC where a stress improvement process was applied within or after the first 2 years of operation. During its audit, the staff reviewed LAS03.G05, “ISI Selection Document – Third Ten-Year Inspection Interval, LaSalle County Station, Units 1 & 2,” Revision 1, dated March 31, 2011, which included inspection schedules and selections for Category B and C welds. The staff noted that the inspection selections for Unit 2 Category B and C welds were 25 and 1, respectively; however, the number specified by BWRVIP-75A was 34 and 2, respectively. Therefore, additional information was necessary to confirm the consistency of the program with GALL Report AMP XI.M7. By letter dated May 29, 2015, the staff issued RAI B.2.1.7-2 requesting that the applicant provide justification as to why the number of Category B and C welds selected for inspection at LSCS, Unit 2, is less than the number specified by BWRVIP-75-A.

In its response dated June 25, 2015, the applicant stated that the table in the referenced ISI selection document is not used for selecting and scheduling inspection of Category B through G welds. The applicant clarified that the 10-year inspection period for BWRVIP-75-A does not correspond with the 10-year ISI interval. The applicant stated that the current 10-year inspection period for BWRVIP-75-A is January 1, 2013, through December 31, 2022, whereas the current 10-year ISI interval is October 1, 2007, through September 30, 2017. The applicant also stated that the program will continue to implement the same frequency and scope for inspections of Category B and C welds through the period of extended operation. The applicant also stated that its program is consistent with the guidance in Table 3-1 of BWRVIP-75-A for inspection frequency and scope of Category B through G welds for normal water chemistry conditions without crediting for implementation of hydrogen water chemistry.

The applicant clarified that 25 percent of the Category B and C welds are inspected during each 10-year period and confirmed that during the first 10-year period (2003 through 2012) inspections were performed on 34 Category B welds and 2 Category C welds on Unit 2, consistent with the guidance in BWRVIP-75-A. The applicant also discussed the inspection status and schedule of Unit 2 welds during the current 10-year period (2013 through 2022) by noting that 14 Category B welds and no Category C welds have been inspected so far. Consequently, at least 20 additional Category B welds and 2 Category C welds will need to be inspected by December 31, 2022, in order to meet the guidance in BWRVIP-75-A.

The staff found the applicant’s response acceptable because (1) the number of inspections for Unit 2 Category B and C welds in the cited inspection selection document do not correlate with the number of inspections required by BWRVIP-75-A because the 10-year ISI interval does not correspond to the same 10-year inspection period for BWRVIP-75-A, (2) the inspection schedule for Unit 2 Category B and C welds for the current 10-year inspection period are consistent with GALL Report AMP XI.M7, and (3) the inspection frequency and scope for Category B through G welds in the program are consistent with BWRVIP-75-A and GALL Report AMP XI.M7. The staff’s concern described in RAI B.2.1.7-2 is resolved.

The staff noted that GL 88-01 indicates that examinations should comply with the applicable Edition and Addenda of the ASME Code, Section XI, as specified in paragraph (g), “Inservice Inspection Requirements,” of 10 CFR 50.55a or as otherwise approved by the NRC. In addition, Information Notice (IN) 98-42, “Implementation of 10 CFR 50.55a(g) Inservice Inspection Requirements,” dated December 1, 1998, indicates that “essentially 100 percent” of the required examination volume for inservice inspections is defined as more than 90 percent of the specified examination volume. However, during the audit, the staff noted that Table B in the LSCS, Unit 2, Post-Outage 90-Day ISI Summary Report, dated May 31, 2013, indicates that the examination coverage of the BWRVIP-75-A inspections on several Category B welds was only 50 percent. The staff notes that, because these welds are classified as augmented inservice inspection, the applicant does not submit relief requests as would be necessary if they were ASME-required inspections. To determine whether the limited examination coverage will adequately manage IGSCC during the period of extended operation, by letter dated

May 29, 2015, the staff issued RAI B.2.1.7-3 requesting that the applicant explain why the examination coverage is limited and justify why the program is adequate to manage cracking due to IGSCC without additional inspections to compensate for the limited examination coverage of each weld category during an inspection period.

In its response dated June 25, 2015, the applicant provided the average examination coverage of each weld category for welds examined between February 2008 and March 2015 at each unit. The applicant clarified that all volumetric weld examinations performed under the scope of the GL 88-01 were, to the maximum examination volume coverage practical, using currently approved performance demonstration initiative (PDI) methods. The applicant stated that where 50-percent examination coverage is reported, the welds are between piping and a cast valve body or other component where the weld configuration is such that the PDI method can only provide qualified and reliable results for the side of the weld adjacent to the piping. The applicant also stated that the issue of less than 90-percent examination coverage for welds has been entered into the Exelon corrective action program for resolution in connection to recently completed weld examinations.

The staff noted that the applicant's response did not provide information regarding the examination coverage of Unit 1 Category A welds and Unit 2 Category C welds. It was also unclear to the staff whether the cast valve body associated with the Unit 2 Category D welds is made of cast material resistant to IGSCC. By letter dated August 18, 2015, the staff issued RAI B.2.1.7-3a requesting that the applicant provide the examination coverage for the two categories not previously provided and provide justification if limited examination coverage is identified. In addition, for the two Category D welds, the staff requested that the applicant provide information to clarify whether the cast materials are resistant to IGSCC and, if available, any internal visual or surface examination results of the valve body per ASME Code Section XI requirements.

In its response dated September 15, 2015, for examination coverages, the applicant included the period from February 2006 through March 2015, and stated that five Unit 1 Category A welds were examined with 100-percent overall examination coverage and that two Unit 2 Category C welds were examined with an overall coverage of 50 percent. The applicant justified the limited coverage by stating that the PDI methods result in a best-effort approach using the best available approved volumetric examination techniques and that Exelon will continue to use the latest commercially available examination techniques that provide coverage to the maximum extent practical. In addition, during the 31-year Unit 2 operating history, there have been no indications of IGSCC for the welds within the program scope.

In its response regarding the valve material associated with the two Unit 2 Category D welds, the applicant clarified that the valve body is fabricated of cast stainless steel SA-351, Grade CF8M with a carbon content of 0.04 percent and a ferrite content of 19.3 percent. The applicant indicated that although the carbon content for the valve body is slightly above the maximum value (0.035 percent) specified in GL 88-01 to be resistant to IGSCC, the ferrite content is significantly above the minimum ferrite content (7.5 percent). The applicant determined that the cast valve body has relatively good resistance to IGSCC based on the evaluation of the carbon and ferrite content. In addition, there have been no maintenance activities that provided an opportunity to internally examine the valve. The applicant also clarified that piping welded to the valve is not resistant to IGSCC and that, if IGSCC were to initiate in these welds, it would likely occur on the piping side rather than the valve side of the weld. The applicant further confirmed that the piping side of these welds is subject to qualified and reliable examination using the PDI method every 6 years in accordance with the examination schedule of BWRVIP-75-A and that no indications of cracking have been identified.

In its review of the valve material associated with the Unit 2 Category D welds, the staff finds the applicant's response acceptable because (1) the cast stainless steel valve body retains resistance to IGSCC based on the ferrite content of the material (19.3 percent), consistent with the criterion specified in GL 88-01 for IGSCC-resistant materials, and (2) the applicant clarified that the program inspects the piping side of the Category D welds, which are susceptible to IGSCC, by using qualified and reliable methods at the inspection frequency specified in GL 88-01 and indicated that these inspections have not identified any indications of cracking. The staff's concern related to the valve material portion of RAI B.2.1.7-3a is resolved.

However, in its review of the examination coverage aspect, the staff received additional information from the Regional Inspectors conducting the IP-71002 inspection at LSCS. The staff became aware that Exelon appears to credit any percentage coverage as meeting the BWR Stress Corrosion Cracking program because BWRVIP-75-A does not specify a percentage for examination coverage. To evaluate the adequacy of the applicant's program, the staff issued RAI B.2.1.7-3b in a letter dated February 16, 2016, to confirm the percentage of examination coverage that Exelon considers meeting BWRVIP-75-A, and to provide the technical bases for crediting examinations when the coverage obtained is less than 90 percent. The staff had identified this as OI 3.0.3.1.5-1.

In its response dated February 25, 2016, the applicant stated that the minimum percentage of weld volume examination coverage for a single weld to be considered "inspected," under the current GL 88-01 program and the BWR Stress Corrosion Cracking program during the period of extended operation, is greater than 90 percent. The applicant also stated that Exelon's implementing procedure currently requires generation of a corrective action issue report for weld examinations that have comparably limited coverage. The applicant also stated that the implementing procedure will be revised to improve clarity for the required extent of evaluation for weld examinations that are only credited under the BWR Stress Corrosion Cracking program, when examination coverage is less than or equal to 90 percent. The revised guidance will require an engineering technical evaluation that provides documented bases comparable to that which would be included in a relief request, had the inspection been an ASME Code examination. Such welds would then be considered "inspected" if they were examined to the maximum coverage attainable using the "performance demonstration initiative" methods. The staff finds the applicant's response acceptable because the program will now ensure that for all limited weld examinations performed by the BWR Stress Corrosion Cracking program, there will be a documented technical basis comparable to that required for an ASME Code relief request. The staff's concern described in RAI B.2.1.7-3b is resolved, and the associated open item, OI 3.0.3.1.5-1, is closed.

Based on its audit and review of the applicant's responses to RAIs B.2.1.7-1, B.2.1.7-2, B.2.1.7-3, B.2.1.7-3a, and B.2.1.7-3b, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M7.

Operating Experience. LRA Section B.2.1.7 summarizes the operating experience related to the BWR Stress Corrosion Cracking program. The applicant indicated that induction heating or a mechanical stress improvement process was performed on all Unit 1 welds and all except two Unit 2 welds that are within the scope of the program. The applicant also stated that the stress improvements were applied to most of the welds before 2 years of operation, illustrating that industry operating experience and staff guidance were applied effectively to mitigate and prevent IGSCC in the welds within the scope of the program. In addition, the applicant confirmed that no indications of cracking were identified during the volumetric examinations performed on the 9 welds in the 2012 Unit 1 RFO or on the 13 welds in the 2013 Unit 2 RFO.

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. 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 evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M7 was evaluated.

UFSAR Supplement. LRA Section A.2.1.7 provides the UFSAR supplement for the BWR Stress Corrosion Cracking program. The staff reviewed this UFSAR supplement description of the program and notes that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Stress Corrosion Cracking 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 UFSAR 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 BWR Penetrations

Summary of Technical Information in the Application. LRA Section B.2.1.8 describes the existing BWR Penetrations program as consistent with GALL Report AMP XI.M8, "BWR Penetrations." The LRA states that the program is a condition monitoring program intended to manage the effects of aging of reactor vessel penetrations exposed to reactor coolant including instrument, control rod drive housing, standby liquid control (SLC)/core plate differential pressure, and incore-monitoring housing penetrations. The LRA also states that the program manages cracking due to stress corrosion cracking (SCC) and IGSCC using management of water chemistry and condition monitoring of reactor vessel penetration welds. The inspection and evaluation activities follow the recommendations in BWRVIP-49-A, "BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines," dated March 2002; BWRVIP-47-A, "BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines," dated June 2004; BWRVIP-27-A, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate Delta-P Inspection and Flaw Evaluation Guidelines," dated August 2003; the requirements of ASME Code Section XI, Subsection IWB; and the recommendations for reactor water chemistry as described in the Water Chemistry (LRA Section B.2.1.2) program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M8. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M8.

Operating Experience. LRA Section B.2.1.8 summarizes operating experience related to the BWR Penetrations program. The LRA states that, during RFOs in 1999 and 2002 for Unit 1 and outages in 2000 and 2003 for Unit 2, the applicant implemented the baseline inspections required by BWRVIP-47-A as part of the BWR Penetrations program, and these inspections identified no cracking or other material condition issues. The LRA also summarizes the results for inspections required by BWRVIP-27-A, conducted in 2008 for Unit 1 and 2007 for Unit 2, which found no recordable indications in the SLC/Core Plate differential pressure penetration to safe end extension welds. Additionally, the applicant conducted VT-2 visual inspections of the instrumentation, CRD housing, incore-monitoring housing, and the SLC/Core Plate differential pressure penetrations during the reactor coolant boundary system leakage test in 2012 and 2013 for LSCS, Units 1 and 2, respectively, and found no leakage from these components.

The staff reviewed operating experience information in the application during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. 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 evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M8 was evaluated.

UFSAR Supplement. LRA Section A.2.1.8 provides the UFSAR supplement for the BWR Penetration program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing BWR Penetrations program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Penetration program, the staff concludes 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). Based on its review, the staff concludes that the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Flow-Accelerated Corrosion

Summary of Technical Information in the Application. LRA Section B.2.1.10, as modified by letter dated August 6, 2015, describes the existing Flow-Accelerated Corrosion program as consistent with an exception with GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," as modified by License Renewal Interim Staff Guidance (LR-ISG)-2012-01, "Wall Thinning due to Erosion Mechanisms." The LRA states that the program predicts, detects, and monitors wall thinning due to flow-accelerated corrosion and erosion in piping and components in reactor coolant, steam, and treated water environments. Specifically, the program includes analytic evaluations, baseline inspections, and followup inspections to confirm predictions and performs repairs and replacements as necessary.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M17. For the "scope of program," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of a request for addition information (RAI), as discussed below.

The "scope of program," "detection of aging effects," and "acceptance criteria" program elements in GALL Report AMP XI.M17 discuss the implementation of Electrical Power Research Institute (EPRI) Nuclear Safety Analysis Center (NSAC)-202L-R2 or NSAC-202L-R3, "Recommendations for an Effective Flow-Accelerated Corrosion Program," dated April 8, 1999 (Revision 2), and August 10, 2007 (Revision 3), as part of the program. Initially, LRA Section B.2.1.10 stated that LSCS's Flow-Accelerated Corrosion program was based on EPRI NSAC-202L-R3. However, during the AMP Audit, it was disclosed that, after the submission of the LRA, the program was being revised to incorporate the guidance in EPRI NSAC-202L-R4, "Recommendations for an Effective Flow-Accelerated Corrosion Program," dated November 26, 2013. This new revision contains alternate recommendations, such as guidance for system evaluation exclusion using a reduced trace chromium content. By letter dated July 7, 2015, the staff issued RAI B.2.1.10-1 requesting that the applicant provide the necessary program element changes associated with the exception to GALL Report AMP XI.M17.

In its response dated August 6, 2015, the applicant identified the technical changes in EPRI NSAC-202L-R4, as they relate to the "scope of program," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of GALL Report AMP XI.M17. In the "scope of program" program element, the applicant identified reduced chromium content down to 0.10 percent as the revised exclusion for components within the system. In the "detection of aging effects" program element, the applicant identified the change for selecting components to include "entrance effect" locations. In the "monitoring and trending" program element, the applicant identified new discussions related to "calibrated lines," "establishing calibration," and "maintaining calibration," and the addition of three new methods for determining wear rates from wall thickness measurements. The applicant also discussed the removal of the hydrazine factor from CHECWORKS™. In the "acceptance criteria" program element, the applicant identified a new discussion regarding consideration of higher safety factors in situations where the measured wall thickness is less than the predicted wall thickness until the cause of the difference is understood or mitigated. With regard to component exclusion for chromium levels down to 0.10 percent, the applicant provided several industry references that served as the bases for this change. In addition, the applicant noted that by letter dated November 5, 2014, NEI had previously provided to the staff the information relating to the three new methods for calculating component wear. As part of its response, the applicant revised

LRA Sections A.2.1.10 and B.2.1.10 to identify that the program now includes an exception by relying on the implementation of EPRI NSAC-202L-R4.

The staff finds the response acceptable because the applicant delineated the specific changes for each program element contained in EPRI NSAC-202L-R4. The staff notes that, as stated in EPRI NSAC-202L, the recommendations have been updated with experiences from the CHECWORKS™ Users Group members and from recent developments in detection, modeling, and mitigation technology that refine and enhance the previous versions. The staff also notes that, in addition to the references cited by the applicant, EPRI 1011837, "Residual Chromium Effects on Flow-Accelerated Corrosion of Carbon Steel," dated March 27, 2006, also evaluated the effects of low chromium content. Based on the above discussion and its evaluation of the information provided by the applicant, the staff's concerns described in RAI B.2.1.10-1 are resolved.

Exception 1. In its response dated August 6, 2015, the applicant identified an exception to the "scope of program," "detection of aging effects," "monitoring and trending," and "corrective action" program elements as a result of using EPRI NSAC-202L-R4, instead of EPRI NSAC-202L-R2 or EPRI NSAC-202L-R3. The staff reviewed this exception against the corresponding program elements in GALL Report AMP XI.M17 and finds it acceptable because, as documented in the applicant's response to RAI B.2.1.10-1 (discussed above), EPRI periodically updates NSAC-202L by refining and enhancing the recommendations from earlier versions with operating experience and recent developments in detection, modeling, and mitigation techniques.

Based on its audit and review of the applicant's response to RAI B.2.1.10-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M17.

Operating Experience. LRA Section B.2.1.10 summarizes operating experience related to the Flow-Accelerated Corrosion program. In April 2013 the applicant identified through-wall leaks downstream of the minimum flow line orifice for the LSCS, Unit 2, high pressure core spray system. The program was able to identify the aging effect of wall thinning due to erosion, and the applicant used the corrective action program to prevent recurrence on this component and similar components through extent of condition inspections. The applicant also described inspections performed during the spring 2013 outage, which included baseline and followup inspections. All 97 of the components inspected met acceptance criteria, demonstrating that the program identifies and monitors wall thinning due to flow-accelerated corrosion.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M17 was evaluated.

UFSAR Supplement. LRA Section A.2.1.10, as modified by letter dated August 6, 2015, provides the UFSAR supplement for the Flow-Accelerated Corrosion program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-01. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Flow-Accelerated Corrosion program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report AMP XI.M17 are consistent. In addition, the staff reviewed the exception and its justifications and determines that the AMP, with the exception, is adequate to manage the applicable aging effects. 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 UFSAR 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 Reactor Vessel Surveillance

Summary of Technical Information in the Application. LRA Section B.2.1.20, as modified by letters dated June 25, 2015, August 26, 2015, and October 29, 2015, describes the existing Reactor Vessel Surveillance program as consistent, with an exception and enhancements, with GALL Report AMP XI.M31, "Reactor Vessel Surveillance." This program manages the loss of fracture toughness of the reactor vessel and nozzles in a reactor coolant and neutron flux environment. The program monitors changes in the fracture toughness properties of ferritic materials in the beltline region of the reactor vessel. BWRVIP-86, Revision 1-A, "Updated BWR Integrated Surveillance Program (ISP) Implementation Plan," dated October 2012, describes the BWRVIP Integrated Surveillance Program (ISP) for the current license term and the extended period of operation. The applicant participates in the BWRVIP ISP in accordance with the requirements in Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M31. For the "detection of aging effect" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "detection of aging effects" program element of GALL Report AMP XI.M31 states that the plant-specific or ISP shall have at least one capsule with a projected neutron fluence equal to or exceeding the 60-year peak reactor vessel wall neutron fluence before the end of the period of extended operation. The program element also states that the program withdraws one capsule at an outage in which the capsule receives a neutron fluence of between 1 and 2 times the peak reactor vessel wall neutron fluence at the end of the period of extended operation and tests the capsule in accordance with the requirements of American Society for Testing and Materials (ASTM) E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated January 1, 1982.

LRA Section B.2.1.20 indicates that the applicant's Reactor Vessel Surveillance program is an existing program that is consistent with GALL Report AMP XI.M31 with no exception or enhancement. LRA Table 4.2.1-4 indicates that the LSCS, Unit 2, peak reactor vessel wall neutron fluence at the end of the period of extended operation is 1.22×10^{18} n/cm^2 (E > 1 MeV). The LRA also states that the applicant is participating in the BWRVIP ISP, which is described in BWRVIP-86, Revision 1-A, and proposes to continue its participation in the BWRVIP ISP for the period of extended operation.

The staff noted that the BWRVIP ISP surveillance capsules for the period of extended operation are called "ISP(E)" capsules and that the surveillance weld and plate materials for LSCS, Unit 2, are irradiated in reactor vessels of other plants as planned in the BWRVIP ISP. The staff also noted that the neutron fluence values for LSCS, Unit 2, ISP(E) surveillance plate and weld materials, as planned in the BWRVIP ISP, are not consistent with the fluence range criterion described in the "detection of aging effects" program element of GALL Report AMP XI.M31. As described above, GALL Report AMP XI.M31 specifies withdrawal of one capsule at an outage in which the capsule receives a neutron fluence of between 1 and 2 times the peak reactor vessel wall neutron fluence at the end of the period of extended operation. Therefore, the staff needed additional information to determine the consistency of the applicant's program with the GALL Report.

By letter dated May 29, 2015, the staff issued RAI B.2.1.20-2 requesting that the applicant clarify whether the applicant's program will test LSCS, Unit 2, surveillance weld and plate materials at neutron fluence levels that are consistent with the neutron fluence range that is specified in GALL Report AMP XI.M31. The staff also requested that, if the neutron fluence values for surveillance materials are not consistent with GALL Report AMP XI.M31, the applicant identify a program exception regarding the neutron fluence range and justify why the exception is acceptable to manage loss of fracture toughness due to neutron irradiation embrittlement for the reactor vessel.

In its response dated June 25, 2015, amended by letter dated August 26, 2015, the applicant stated that the LSCS, Unit 2, ISP(E) representative weld material is located in a Susquehanna Steam Electric Station, Unit 1, surveillance capsule that has a planned fluence exposure of 8.67×10^{17} n/cm^2, which is less than the 60-year peak fluence value of 1.14×10^{18} n/cm^2 that is projected for the limiting LSCS, Unit 2, beltline weld as shown in LRA Table 4.2.1-5. The applicant also indicated that the LSCS, Unit 2, ISP(E) representative plate material is located in a River Bend Nuclear Station reactor capsule that has a planned fluence exposure of 4.49×10^{18} n/cm^2, which exceeds 2 times the 60-year peak fluence value of 1.22×10^{18} n/cm^2 that is projected for the limiting LSCS, Unit 2, plate as shown in LRA Table 4.2.1-4. The applicant further stated that, because the planned exposures for each of the LSCS, Unit 2, ISP(E) capsules fall outside the specified fluence exposure range, an exception is taken to the GALL Report AMP XI.M31 "detection of aging effects" program element. In addition, the applicant revised LRA Section B.2.1.20, Table 3.1.1, and Table 3.1.2-2, consistent with the identification of the program exception.

In its response, the applicant stated that the heat numbers for the representative weld and plate materials in the ISP(E) capsules do not match the heat numbers of the LSCS, Unit 2, limiting beltline weld and plate materials. The applicant also stated that, in these cases, it computes the adjusted reference temperature (ART) using the method specified in BWRVIP-135, Revision 3, Procedure Number 2, "Recommended Guidance for the Use of ISP Surveillance Data when Vessel Material and Surveillance Material Heat Numbers Do Not Match." The applicant further stated that this method determines the chemistry factor using Tables 1 and 2 of RG 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, dated May 1988, based on the copper and nickel content of the actual LSCS reactor vessel weld and plate materials.

In addition, the applicant indicated that, because of the chemistry factor calculation using Tables 1 and 2 of RG 1.99, Revision 2, the LSCS embrittlement calculations for the reactor vessel are not affected by the fact that the representative ISP(E) surveillance capsules applicable to LSCS, Unit 2, have planned fluence exposure values outside of the fluence range specified in GALL Report AMP XI.M31. The applicant also indicates that this conclusion is supported by Section 7.2 of the staff-approved BWRVIP-86, Revision 1-A, which states, "There are some cases in which capsule fluence will be less than 100 percent of the 1/4T EOLE (End of License–Extended) fluence. However, the practical consequence is not significant. In most of those cases, the representative material in the capsule is not the same heat as the target vessel material; thus, the target plants will utilize Regulatory Guide 1.99, Revision 2, chemistry factor tables to determine a chemistry factor for calculating predicted embrittlement shift."

In its review, the staff finds the applicant's response acceptable because (1) the applicant clarified that the heat numbers of the ISP(E) representative plate and weld materials for LSCS, Unit 2, do not match the heat numbers of the limiting LSCS, Unit 2, plate and weld materials, respectively, (2) the applicant confirmed that, for those limiting materials of LSCS, Unit 2, the chemistry factor tables of RG 1.99, Revision 2, will be used to calculate chemistry factors and ARTs consistent with the guidance in RG 1.99, Revision 2, and (3) the applicant adequately identified a program exception regarding the neutron fluence range of the surveillance materials for the LSCS, Unit 2, reactor vessel. The staff's concern described in RAI B.2.1.20-2 is resolved.

The staff also reviewed the portions of the "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" 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 the exception and enhancements follows.

Exception 1. As discussed above, the applicant revised LRA Section B.2.1.20 to identify a program exception in its response dated June 25, 2015, to RAI B.2.1.20-2. In this exception, the applicant indicated that GALL Report AMP XI.M31 states that the program withdraws one capsule at an outage in which the capsule receives a neutron fluence of between 1 and 2 times the peak reactor vessel wall neutron fluence at the end of the period of extended operation and tests the capsule in accordance with the requirements of ASTM E185-82. The applicant also indicated that, because the neutron fluence values for LSCS, Unit 2, ISP(E) surveillance plate and weld materials, as planned in the BWRVIP ISP, are not consistent with this fluence range criterion, a program exception is identified. The applicant further provided justification for the program exception in its response to RAI B.2.1.20-2.

As previously discussed, the staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M31 and finds it acceptable because the applicant clarified that (1) the heat numbers of the ISP(E) representative plate and weld materials for LSCS, Unit 2, do not match the heat numbers of the limiting LSCS, Unit 2, plate and weld materials, respectively and (2) for those limiting materials of LSCS, Unit 2, the chemistry factor tables of RG 1.99, Revision 2, will be used to calculate chemistry factors and ARTs, consistent with the guidance in RG 1.99, Revision 2.

Enhancements 1 and 2. As described in its letter dated August 26, 2015, the applicant identified enhancements to the Reactor Vessel Surveillance Program. In the enhancements, the applicant stated that (1) prior to the period of extended operation, a monitoring limit for neutron fluence will be established at the limiting Unit 1 axial weld (currently 39.15 effective full-power years (EFPY)) that corresponds to the axial weld failure probability of 5.02×10^{-6} per reactor year specified in the Supplement to the Final Safety Evaluation of the BWRVIP-05 Report dated March 7, 2000; and (2) prior to 39.15 EFPY, a probabilistic axial weld failure analysis will be completed for Unit 1 that demonstrates the 60-year axial weld failure probability is no greater than 5.02×10^{-6} per reactor year.

By letter dated October 23, 2015, the staff issued RAI 4.2.5-1a requesting that the applicant (1) clarify whether the program includes an enhancement that operating restrictions will be established to ensure that the Unit 1 reactor is operated within the neutron fluence range for which the analysis remains valid, and if not, justify why such enhancement is not identified; and (2) clarify whether it will submit an updated analysis on the Unit 1 reactor vessel axial weld failure probability for staff's review and approval sufficiently in advance of the reactor vessel fluence level exceeding the fluence range for which the applicant's analysis remains valid (e.g., submittal at least 3 years before the analysis is projected to become invalid). In addition, the staff requested that the applicant ensure that the applicant's program enhancements are consistent with the applicant's response.

In its response dated October 29, 2015, the applicant revised LRA Sections A.2.1.20 and B.2.1.20 to include enhancements to the "monitoring and trending," "acceptance criteria," and "corrective actions" program elements. In this enhancement, the applicant stated that, prior to the period of extended operation, a maximum fluence limit of 6.25×10^{17} n/cm^2 will be established for monitoring the limiting Unit 1 axial welds to ensure that the axial weld failure probability does not exceed 5.02×10^{-6} per reactor year. The staff noted that the limitation established in this enhancement is consistent with the applicant's revised basis for accepting the reactor vessel failure probability analysis for LSCS, Unit 1, in accordance with 10 CFR 54.21(c)(1)(iii). SER Section 4.2.5 provides that the staff's evaluation of the basis for accepting this time-limited aging analysis (TLAA) in accordance with 10 CFR 54.21(c)(1)(iii) using the enhancement and commitment in Commitment No. 20 of UFSAR Supplement Table A.5. In Commitment No. 20, the applicant committed, in part, to submitting a revised probability of failure analysis for LSCS, Unit 1, for NRC review and approval at least 3 years prior to the time when the limiting Unit 1 axial welds will reach a limiting neutron fluence of 6.25×10^{17} n/cm^2 (E > 1.0 MeV).

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M31 and finds it acceptable because (1) the enhancement will monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region resulting from exposure to neutron irradiation and the thermal environment, which is in accordance with Appendix H to 10 CFR Part 50, and (2) the applicant has established operating restrictions on the monitoring of the neutron fluence for LSCS, Unit 1, reactor vessel axial welds consistent with the enhancement in Commitment No. 20, as stated in UFSAR Supplement Table A.5.

Operating Experience. LRA Section B.2.1.20 summarizes operating experience related to the applicant's Reactor Vessel Surveillance 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. 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 evaluated and incorporated operating experience related to this program. During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of RAIs, as discussed below.

LRA Section B.2.1.20 indicates that the 120-degree capsule of LSCS, Unit 1, was withdrawn from the Unit 1 reactor vessel in 2010 as planned in the BWRVIP ISP. The LRA also indicates that the weld and plate surveillance materials were tested and that the test results were published in BWRVIP-250NP and BWRVIP Letter 2012-036. The LRA further indicates that the credible data for weld heat 1P3571 obtained from the surveillance testing were used to update the LSCS, Unit 1, Pressure-Temperature (P-T) curves.

The staff noted that BWRVIP-250NP indicates that the testing and evaluation of the surveillance capsules was completed in 2011. The staff also noted that the BWRVIP ISP described in BWRVIP-86, Revision 1, indicates that recently (within the past several years) a capsule containing the ISP surveillance weld material for LSCS, Unit 2, should have been withdrawn from a host plant for surveillance testing. However, the staff noted that LRA Section B.2.1.20 does not discuss whether evaluation of the surveillance data for LSCS, Unit 2, is included in the LRA.

The staff also noted that LRA Tables 4.2.3-2 and 4.2.3-4 address ART and related data under the heading of "Integrated Surveillance Program Chemistry Values from BWRVIP-135, Revision 2." The staff further noted that BWRVIP-135, Revision 2, was published as an ISP data source book in October 2009, before the most recent surveillance capsule withdrawals for LSCS, Units 1 and 2, as indicated in the references section of the LSCS, Unit 1, P-T limits report, dated January 3, 2014. Therefore, the staff needed additional information to confirm whether the LRA describes the evaluation of the most recent surveillance capsule data for LSCS, Units 1 and 2.

By letter dated May 29, 2015, the staff issued RAI B.2.1.20-3 requesting that the applicant clarify whether the LRA describes the evaluation of the most recent surveillance capsule data for LSCS, Units 1 and 2 (including LRA Tables 4.2.3-2 and 4.2.3-4).

In its response dated June 25, 2015, the applicant clarified that the LSCS, Unit 1, surveillance material chemistry values provided in LRA Table 4.2.3-2 are from the LSCS, Unit 1, 120-degree capsule that was withdrawn in 2010 and tested in 2011. The applicant also clarified that the LSCS, Unit 2, surveillance material chemistry values provided in LRA Table 4.2.3-4 are from the Susquehanna Steam Electric Station, Unit 1, 120-degree surveillance capsule that was withdrawn in March 2012 and is applicable to LSCS, Unit 2. The applicant further clarified that the references to BWRVIP-135, Revision 2, in the table headings are not current and that these references are updated to BWRVIP-135, Revision 3 (December 2014). In addition, the applicant stated that references to BWRVIP-135, Revision 2, in the text of LRA Section 4.2.3, Table 4.2.3-2, Table 4.2.3-4, and Reference 4.8.5 have also been updated to refer to BWRVIP-135, Revision 3.

In its review, the staff finds the applicant's response acceptable because the applicant clarified that the LRA includes the evaluation of the most recent surveillance data. The staff's concern described in B.2.1.20-3 is resolved.

The operating experience discussed in LRA Section B.2.1.20 indicates that, because a damaged spring was discovered on the LSCS, Unit 2, 120-degree capsule in 2007, it was removed from the reactor vessel and placed in the spent fuel pool where it will remain indefinitely. The LRA also indicates that, because LSCS, Unit 2, is not a host plant of the BWRVIP ISP, the capsule does not require surveillance testing as part of the ISP.

In its review of the operating experience, the staff noted that the LRA does not provide sufficient information on the applicant's assessment of the plant-specific operating experience to ensure prevention of similar events that can impact the availability of reactor vessel surveillance capsules.

By letter dated May 29, 2015, the staff issued RAI B.2.1.20-4 requesting that the applicant provide the following information to demonstrate adequate assessment of the operating experience regarding reactor vessel surveillance capsules: (1) the role of the damaged spring, (2) the nature of the damage (including the cause), (3) the assessment of the plant-specific operating experience as applied to the other surveillance capsules, and (4) the identification of activities, as needed, to prevent similar events from occurring to the other capsules.

By letter dated June 25, 2015, the applicant responded to RAI B.2.1.20-4 as follows. In its response regarding the role of the spring, the applicant stated that, inside each reactor vessel in the beltline region where the fuel is located, upper and lower brackets are welded to the inside surface of the vessel wall that hold each of three surveillance capsule holders to the reactor vessel wall. The applicant also stated that the upper bracket has a 90-degree upward bend and that the lower bracket has a 90-degree downward bend. The applicant further stated that these upper and lower brackets are used to support the surveillance capsule assembly and to locate it in the proper position within the reactor vessel.

The applicant further stated that the top of the surveillance capsule holder has a fixed bracket, whereas the bottom of the capsule holder has a spring-loaded rod with a ring on its end used for attaching the holder to the lower bracket. In addition, the applicant stated that, to install the capsule holder, the ring at the bottom of the spring-loaded rod is engaged with the lower support bracket and that the capsule holder is raised to seat the top of the holder over the upper bracket. The applicant indicated that, as the capsule holder is raised, the spring inside the capsule holder allows the rod to extend out from the bottom of the holder, allowing the assembly to elongate. The applicant also indicated that the spring maintains compression on both brackets once the capsule holder is in position.

In its response regarding the nature of the damage, the applicant indicated that, in 2005, the LSCS, Unit 2, 120-degree surveillance capsule holder lower ring was found out of its design orientation and not properly engaged with the lower bracket. The applicant also indicated that the lower ring of the capsule holder was marginally located under the 90-degree downward bend portion of the bracket. The applicant indicated that it appeared that water flow had pushed the capsule holder away from the reactor vessel wall toward the shroud. The applicant further stated that the external components of the surveillance capsule holder were visually examined and that no additional deviations or defects were noted.

In addition, the applicant stated that, because the spring is mounted on the lower bracket rod, inside the surveillance capsule holder, it is not visible for inspection. The applicant stated that the cause of the damage could not be determined. The applicant also indicated that the apparent cause of the loss of preload was determined to be a damaged spring because removal of the spring force would allow the capsule holder to relax, thus permitting the ring to disengage from the lower bracket.

In its response regarding assessment of operating experience and actions to prevent similar events, the applicant indicated that LSCS, Unit 2, is not a host plant in the BWRVIP ISP. The applicant also indicated that since the Unit 2 120-degree capsule was not scheduled for testing, the capsule was removed from the reactor vessel in 2007 and was placed in the fuel pool for long-term storage where it is available for future repair and reinsertion if needed. The applicant further indicated that each of the LSCS reactors has one remaining surveillance capsule installed.

In addition, the applicant stated that, during each RFO, a VT-3 visual examination is performed to verify that the remaining surveillance capsule holder is in place, intact, and has not been damaged during operation or other in-vessel activities. The applicant stated that every 2 years, when a VT-3 visual examination is performed on the welds connecting the attachment lugs to the reactor pressure vessel (RPV), the orientation of the capsule holder is also confirmed. The applicant also stated that additionally, during examinations of other components in the area of the capsule holder, the orientation of the capsule holder is confirmed. The applicant further stated that the corrective action program would identify and address any misalignment of the surveillance capsule holder.

In its review, the staff finds the applicant's response acceptable because the applicant clarified that (1) the spring inside the surveillance capsule holder is used to maintain compressive loading for installation of surveillance capsules, (2) in the 2015 operating experience, the lower support ring of the Unit 2 capsule holder was found out of its design orientation, and no other adverse indications were observed from the visual examination of the external components of the capsule holder, (3) the LSCS, Unit 2, 120-degree capsule was placed in the spent fuel pool for potential future use; (4) each of the LSCS reactors has only one remaining surveillance capsule installed, and (5) visual inspections are periodically performed on the surveillance capsule holders in the reactor vessels to ensure that the capsule holders remain intact. The staff's concern described in RAI B.2.1.20-4 is resolved.

Based on its audit and review of the application and the applicant's responses to RAIs B.2.1.20-3 and B.2.1.20-4, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M31 was evaluated.

UFSAR Supplement. LRA Section A.2.1.20 provides the UFSAR supplement for the applicant's Reactor Vessel Surveillance program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1. The staff identified a concern that required the issuance of an RAI as described below.

LRA Section A.2.1.20 states that the schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86-A for the current license term and for the period of extended operation. The staff noted that the abstract section of BWRVIP-86, Revision 1-A, "Updated BWR Integrated Surveillance Program (ISP) Implementation Plan," dated October 2012, states the following:

> This report identifies the test matrix of capsules containing the representative weld and plate materials and the planned schedule for withdrawal and testing. The content of BWRVIP-116 (ISP for the License Renewal Period) was merged with BWRVIP-86-A (ISP Implementation Plan) to provide a single, comprehensive implementation plan for the ISP during both the original and renewed license period. This report (BWRVIP-86, Revision 1-A) incorporates changes proposed by the BWRVIP in response to the NRC Request for

Additional Information, recommendations in the NRC Safety Evaluation and other necessary revisions identified since the previous publication of this report.

During the audit, the staff noted that the applicant's implementation procedure (ER-ABB-331-103, Revision 3) for the Reactor Vessel Surveillance program includes references to both BWRVIP-86-A and BWRVIP-86, Revision 1-A. As discussed above, the staff also noted that BWRVIP-86-A (October 2002) describes the ISP implementation plan for the original license period developed before the issuance of BWRVIP-86, Revision 1, whereas BWRVIP-86, Revision 1-A, describes the staff-approved ISP implementation plan for both the original and extended license period. The staff further noted that the UFSAR supplement description for the Reactor Vessel Surveillance program includes a reference to BWRVIP-86-A (October 2002) rather than to BWRVIP-86, Revision 1-A (October 2012).

By letter dated May 29, 2015, the staff issued RAI B.2.1.20-1 requesting that the applicant justify why the UFSAR supplement does not include a reference to BWRVIP-86, Revision 1-A (October 2012). The staff also requested alternatively that the applicant revise the UFSAR supplement to include a reference to BWRVIP-86, Revision 1-A, as the ISP implementation plan.

In its response dated June 25, 2015, the applicant stated that the UFSAR supplement presented in LRA Section A.2.1.20 and the program summary presented in LRA Section B.2.1.20 are revised to change the reference from BWRVIP-86-A to BWRVIP-86, Revision 1-A. The applicant also stated that LRA Section 3.1.2.2.3 is also revised to clarify that the schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86, Revision 1-A, for the current license term and for the period of extended operation. The applicant further stated that Exelon procedure ER-AB-331-103 will also be revised to change the reference to BWRVIP-86, Revision 1-A.

In its review, the staff finds the applicant's response acceptable because the applicant provided an adequate revision to the LRA and implementing procedure, including LRA Sections A.2.1.20 (UFSAR supplement) and B.2.1.20 (program description), that correctly refers to BWRVIP-86, Revision 1-A, instead of BWRVIP-86-A. Therefore, the UFSAR supplement for the Reactor Vessel Surveillance program is consistent with the corresponding program description in SRP-LR Table 3.0-1. The staff's concern described in RAI B.2.1.20-1 is resolved. The staff finds that the information in the UFSAR supplement, as amended by letter dated June 25, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Reactor Vessel Surveillance program, the staff determined 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 determined that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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

Summary of Technical Information in the Application. LRA Section B.2.1.21 describes the new One-Time Inspection program as consistent with GALL Report AMP XI.M32, "One-Time Inspection." The LRA states that the One-Time Inspection program manages loss of material, cracking, and reduction of heat transfer in piping, piping components, piping elements, heat exchangers, and other components within the scope of license renewal. The LRA also states that the One-Time Inspection program proposes to manage these aging effects with inspections that focus on locations that are isolated from flow streams (i.e., that are stagnant or that have low flow for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects). Additionally, the One-Time Inspection program is used to verify the system-wide effectiveness of the Water Chemistry (LRA Section B.2.1.2), Fuel Oil Chemistry (LRA Section B.2.1.19), and Lubricating Oil Analysis (LRA Section B.2.1.26) programs, which are designed to prevent or minimize aging to the extent that it will not cause a loss of intended function.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M32. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M32.

Operating Experience. LRA Section B.2.1.21 summarizes operating experience related to the One-Time Inspection program. In October 2012 the applicant performed a UT examination of a nonsafety-related service water system pipe and identified localized pitting where the wall thickness was below minimum wall thickness requirements. The pitting was entered into the corrective action program. An evaluation was performed, and the applicant determined that the piping in its current condition would continue to meet its function of maintaining pressure boundary and structural integrity, but it would need to be replaced during the February 2013 RFO.

In March 2012, the applicant performed a UT examination of the safety-related 1A fuel pool emergency makeup pump suction piping and identified localized pitting where the wall thickness was below the ASME Code minimum wall thickness requirements. The pitting was entered into the corrective action program. In 2009, the applicant performed another UT at the same location of the pipe. An evaluation was completed and determined that the results were acceptable based on the rate of material loss, and through-wall degradation was predicted to occur in approximately 2015. Because the piping had already reached its minimum wall thickness and had active pitting, it was concluded that this piping could no longer perform its design function. As a result, the affected fuel pool emergency makeup pump suction piping and the 1A fuel pool emergency makeup pump were isolated from service and subsequently replaced.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M32 was evaluated.

UFSAR Supplement. LRA Section A.2.1.21 provides the UFSAR supplement for the One-Time Inspection program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the new One-Time Inspection program within 10 years before the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's One-Time Inspection program, the staff concludes 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 UFSAR 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 Selective Leaching

Summary of Technical Information in the Application. LRA Section B.2.1.22 describes the new Selective Leaching program as consistent with GALL Report XI.M33, "Selective Leaching," as modified by LR-ISG-2011-03 and LR-ISG-2012-02. The LRA states that the program ensures the integrity of gray cast iron and copper alloy (with greater than 15-percent zinc) components that are susceptible to loss of material due to selective leaching. The LRA also states that there are no in-scope aluminum bronze components with an aluminum content greater than 8 percent. The program manages selective leaching in the service environments of raw water, closed cycle cooling water, treated water, wastewater, and soil. The program will manage this aging effect through a one-time visual inspection coupled with hardness measurement or other mechanical examination techniques. The LRA also states the minimum population size of components inspected by this program and states that those inspections should be performed on the bounding or leading components most susceptible to aging due to time in service, severity of operating condition, and lowest design margin. Subsequent to the issuance of the SER with open items, the staff issued LR-ISG-2015-01. By letter dated April 13, 2016, the applicant revised its Selective Leaching program to credit the recommendations associated with the selection of buried components for selective leaching inspections discussed in LR-ISG-2015-01. The applicant also removed reference to LR-ISG-2011-03.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M33.

Staff-Identified Difference. LRA Section B.2.1.22 does not include aluminum bronze as a material susceptible to selective leaching and does not take an exception to GALL Report AMP XI.M33. This staff-identified difference affects the "program description." The staff's review of the LRA and UFSAR supplement confirmed that there are no aluminum bronze components in the scope of license renewal.

The staff reviewed the difference between the LRA AMP and the GALL Report AMP, which should have been identified as an exception, and finds it acceptable because there are no aluminum bronze components in the scope of license renewal. Therefore, the aspects of the AMP associated with the staff-identified difference are not applicable.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M33 as modified by LR-ISG-2011-03 and LR-ISG-2012-02. The staff also reviewed the difference between the LRA AMP and the GALL Report AMP associated with the "program description" and dispositioned the staff-identified difference as acceptable. The staff finds that the AMP, with the staff-identified exceptions, is adequate to manage the applicable aging effects.

The staff finds the applicant's use of the recommendations associated with the selection of buried components for selective leaching inspections discussed in LR-ISG-2015-01 in lieu of LR-ISG-2011-03 acceptable. As stated in LR-ISG-2015-01, "the recommendations in AMP XI.M41 related to reductions in the extent of inspections for AMP XI.M33, 'Selective Leaching,' have been moved to AMP XI.M33 [from LR-ISG-2011-03] with no technical changes."

Operating Experience. LRA Section B.2.1.22 summarizes operating experience related to the Selective Leaching 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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M33 was evaluated.

UFSAR Supplement. LRA Section A.2.1.22 provides the UFSAR supplement for the Selective Leaching program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the new Selective Leaching program before the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Selective Leaching program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff evaluated a staff-identified difference and determined that the AMP, with the staff-identified difference, is adequate to manage the applicable aging effects. 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 UFSAR 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 Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping

Summary of Technical Information in the Application. LRA Section B.2.1.23 describes the applicant's Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program, as a new condition motoring program that will manage cracking of small-bore reactor coolant piping consistent with GALL Report AMP XI.M35. The LRA states that the program will perform one-time inspection of a sample of ASME Code Class 1 piping less than nominal pipe size (NPS) 4-inches and greater than or equal to NPS 1-inch in Unit 1. The LRA also states that a one-time inspection program is applicable to LSCS, Unit 1, to adequately manage the aging effect of cracking for ASME Code Class 1 small-bore piping due to SCC, cyclical loading, and thermal stratification or thermal turbulence. The LRA further states that use of the program is consistent with GALL Report AMP XI.M35, which is limited to plants that have not experienced cracking of ASME Code Class 1 small-bore piping due to SCC, cyclical loading, and thermal stratification or thermal turbulence. The LRA states that the scope of the program includes one-time inspection of a sample of ASME Code Class 1 piping less than NPS 4-inches and greater than or equal to NPS 1-inch for pipes, fittings, branch connections, and full penetration (butt) welds and partial penetration (socket) welds.

The LRA originally included a single One-time Inspection of ASME Code Class 1 Small-Bore Piping program to manage cracking of small-bore reactor coolant piping in both units at LSCS. However, during the review, the applicant revised the program to only apply to LSCS, Unit 1, and created a new plant-specific program to manage cracking of small-bore reactor coolant piping in LSCS, Unit 2. The staff evaluation below concerns the LSCS, Unit 1, program, and the plant-specific program for LSCS, Unit 2, is discussed in SER Section 3.0.3.3.2.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M35.

For the "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The staff noted that GALL Report AMP XI.M35 states under the "detection of aging effects" program element that "[t]his inspection should be performed at a sufficient number of locations to ensure an adequate sample. This number, or sample size, is based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of ASME Code Class 1 small-bore piping locations." Because LRA Sections B.2.1.23 and A.2.1.23 did not provide the total number of in-scope small-bore piping welds, it was not clear to the staff how the inspection sample will be selected and thus whether a sufficient number of locations will be inspected to ensure that cracking will be adequately managed. By letter dated July 7, 2015, the staff issued RAI B.2.1.23-1, requesting that the applicant provide the population of in-scope small-bore piping welds for each weld type (i.e., butt welds and socket welds) at each unit. The staff also requested that, based on the population, the applicant justify the adequacy of the selected sample size for each type of weld.

By letter dated August 6, 2015, the applicant responded to RAI B.2.1.23-1 and provided the approximate population of ASME Code Section III, Class 1, in-scope small-bore piping butt welds and socket welds for both units. The applicant stated that the one-time inspection sample size for LSCS, Unit 1, will include at least 3 percent of the population of butt welds (483) and the population of socket welds (108), with a maximum of 10 butt welds and socket welds. The applicant also stated that the sampling methodology for LSCS, Unit 1, is consistent with the guidance provided in GALL Report AMP XI.M35 for a unit that has not experienced age-related failure of in-scope small-bore piping. The applicant further stated that because LSCS, Unit 2, has experienced age-related failure of a Class 1 small-bore piping, a plant-specific periodic inspection program will be implemented for LSCS, Unit 2, consistent with the guidance provided in GALL Report AMP XI.M35. As part of its response, the applicant revised LRA Sections A.2.1.23 and B.2.1.23 to include the number of LSCS, Unit 1, small-bore piping welds.

The staff noted that the applicant provided information on the total number of small-bore piping welds and the selected sample sizes. The staff also noted that the applicant's sampling methodology for the population of its small-bore piping welds is consistent with the inspection sampling guidance provided in GALL Report AMP XI.M35, which recommends that the inspection plan should include 3 percent of the weld population or a maximum of 10 welds for each weld type for units that have more than 30 years of operation and have not experienced age-related failures (LSCS, Unit 1). The staff's concern described in RAI B.2.1.23-1 for LSCS, Unit 1, is resolved. The staff further noted that the applicant stated that it will implement a plant-specific periodic inspection program for LSCS, Unit 2, consistent with the guidance provided in GALL Report AMP XI.M35. The staff's evaluation of the applicant's plant-specific AMP for LSCS, Unit 2, is provided in SER Section 3.0.3.3.2.

The staff noted that GALL Report AMP XI.M35 states, under the "detection of aging effects" program element, that the one-time inspection under this program does not apply to plants that have experienced cracking in ASME Code Class 1 small-bore piping due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. LRA Section B.2.1.23 states that LSCS, Units 1 and 2, have not experienced this type of cracking. However, the LRA also states that the applicant's review identified two issues with ASME Code Class 1 small-bore piping welds during startup of LSCS, Unit 1, in 1983. The LRA further states that a pinhole leak was identified on an ASME Code Class 1 small-bore socket weld in 2005 at LSCS, Unit 2. The applicant states that the pinhole leak was caused by an inclusion or defect in a weld repair performed in 1995. Based on the staff's review of the available information, the staff determined that the documented failures were most likely age related and caused by vibration and/or thermal fatigue. Given the documented operating experience at LSCS of multiple failures of socket welds, it is not clear to the staff why the applicant has determined that a one-time inspection of its socket weld population would be applicable.

By letter dated July 7, 2015, the staff issued RAI B.2.1.23-2 and requested that the applicant provide information in terms of metallurgical analysis to support the determination that the multiple socket weld failures described above do not constitute failures of ASME Code Class 1 small-bore piping due to cyclical mechanical or thermal fatigue. The staff further requested that, if the referenced failures of ASME Code Class 1 small-bore socket welds could be attributed to vibration or thermal fatigue induced cracking, the applicant should provide a plant-specific program that includes periodic inspections; otherwise, it should justify how the One-time Inspection of ASME Code Class 1 Small Bore Piping program will adequately manage cracking consistent with the guidance provided in the GALL Report AMP.

By letter dated August 6, 2015, the applicant provided its response to RAI B.2.1.23-2 and stated that the socket weld failures for LSCS, Unit 1, on the drain line connections to the main steam isolation valves, occurred after less than 9 months of intermittent service during the initial cycle of the unit. The applicant also stated that the causes for these failures were determined to be improper welding, installation, less-than-optimum preheat treatment, and choice of welding electrodes. The applicant further stated that the corrective actions from these failures included design changes and rewelding all similar socket welds on the drain line connections to the main steam isolation valves using improved welding procedures and using instrumentation to verify that abnormal vibrations and frequencies do not exist. The applicant stated that LSCS, Unit 1, has operated for more than 32 years with no subsequent indications of cracking or degradation on any of its ASME Class 1 small-bore piping; therefore, the One-time Inspection of ASME Code Class 1 Small-Bore Piping program is considered applicable and consistent with the guidance provided in GALL Report AMP XI.M35.

The staff noted that, based on the operating information provided in the RAI response, the failures in 1983 at LSCS, Unit 1, were most likely fabrication related and not age related and were successfully mitigated by the applicant's design changes. Because the issues related to the failures were successfully mitigated, and because the failures were not attributed to age-related degradation as described in GALL Report AMP XI.M35, the staff finds the applicant's use of the One-time Inspection of ASME Code Class 1 Small-Bore Piping program to manage the aging of the LSCS, Unit 1, acceptable. Therefore, the staff's concern in RAI B.2.1.23-2, as it related to LSCS, Unit 1, is resolved. The staff's evaluation of the applicant's plant-specific AMP for LSCS, Unit 2, is provided in SER Section 3.0.3.3.2.

Based on its audit and review of the applicant's responses to RAIs B.2.1.23-1 and B.2.1.23-2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M35.

Operating Experience. LRA Section B.2.1.23 summarizes operating experience related to the applicant's program. The LRA states that the applicant performed an extensive review of plant operating experience of ASME Code Class 1 small-bore piping, which included review of the corrective action program database, review of correspondence to the NRC, and interviews with the LSCS ISI program owner. The applicant stated that the review did not identify any cracking of ASME Code Class 1 piping due to fatigue or SCC. The applicant also stated that the review identified two issues with welds during startup in 1983 and a pinhole leak in 2005. The applicant further stated that the root cause evaluations concluded that these issues were fabrication related.

The applicant stated that, since 2002 (for LSCS, Unit 1) and 2003 (for LSCS, Unit 2), it has performed periodic examinations of ASME Code Class 1 small-bore piping butt welds and socket welds, and there were no unacceptable indications except for the pinhole leak in 2005.

As stated earlier, the applicant provided additional operating experience information in response to RAI B.2.1.23-2 and has determined that the pinhole leak for Unit 2 was age related. Consequently, the applicant stated that for LSCS, Unit 2, it will implement a plant-specific AMP that includes periodic inspections to manage aging of ASME Class 1 small-bore piping. (The staff's evaluation of this program is discussed in SER Section 3.0.3.3.2.)

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. 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 evaluated and incorporated operating experience related to this program.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program for LSCS, Unit 1.

Based on its audit, review of the application, and review of the applicant's response to RAI B.2.1.23-2, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which the GALL Report AMP XI.M35 was evaluated.

UFSAR Supplement. LRA Section A.2.1.23, as revised by letter dated August 6, 2015, provides the UFSAR supplement for the Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program at LSCS, Unit 1. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0–1. The staff also noted that the applicant committed to implement the new Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program within the 6 years before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program at LSCS, Unit 1, the staff concludes 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 External Surfaces Monitoring of Mechanical Components

Summary of Technical Information in the Application. LRA Section B.2.1.24 describes the External Surfaces Monitoring of Mechanical Components program as a new program that is consistent with GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation," and LR-ISG-2011-03, "Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, 'Buried and Underground Piping and Tanks.'" The LRA states that the program is a condition monitoring program that directs that visual inspections of external surfaces of components must be performed during system inspections and walkdowns. The LRA also states that the AMP manages the aging effects of cracking, hardening and loss of strength, loss of material, and reduced thermal insulation resistance of metallic and elastomeric materials through visual inspection of external surfaces for evidence of loss of material, cracking, and changes in material properties. The LRA further states that it will perform periodic representative inspection of outdoor insulated components except tanks and of indoor insulated components and tanks where the process fluid temperature is below the dew point. The program also specifies that acceptance criteria for each component and aging effect combination are defined to ensure that the need for corrective actions is identified.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M36, as modified by LR-ISG-2011-03 and LR-ISG-2012-02. For the "parameters monitored or inspected" and "detection of aging effects" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "detection of aging effects" program element in GALL Report AMP XI.M36 recommends that "[t]ightly adhering insulation is considered to be a separate population from the remainder of insulation installed on in-scope components. The entire population of in-scope piping that has tightly adhering insulation is visually inspected for damage to the moisture barrier with the same frequency as for other types of insulation inspections." LRA Section B.2.1.24 states in the "program description" that "the program does not require removal of tightly-adhering insulation that is impermeable to moisture unless there is evidence of damage to the moisture barrier. Instead, the program includes visual inspection of the entire accessible population of piping and components during each 10-year period of the period of extended operation." It is not clear to the staff which criteria were used to identify components as "accessible" and what the basis for the acceptability of not inspecting inaccessible insulation was. By letter dated July 7, 2015, the staff issued RAI B.2.1.24-1 requesting that the applicant explain the criteria used in establishing categories of the "accessible" population and justify program adequacy if only the "accessible" population is inspected. In addition, the RAI requested the insulation material type and environment for the inaccessible insulation.

In its response dated August 6, 2015, the applicant stated that it had reviewed all of the tightly adhering insulation locations and had confirmed that there is no insulation in these locations that would be considered inaccessible. As a result, the applicant updated LRA Section B.2.1.24 and removed the word "accessible" from the program. The staff finds the applicant's response acceptable because visual inspections will be performed consistent with GALL Report AMP XI.M36. The staff's concern described in RAI B.2.1.24-1 is resolved.

The "detection of aging effects" program element in GALL Report AMP XI.M36 recommends that "[f]or all outdoor components (except tanks) and any indoor components exposed to condensation (because the in-scope component is operated below the dew point), inspections are conducted of each material type (e.g., steel, stainless steel, copper alloy, aluminum) and environment (e.g., air-outdoor, moist air, air accompanied by leakage) where condensation or moisture on the surfaces of the component could occur routinely or seasonally." LRA Section B.2.1.24 states in the "program description" that "[i]nspections are conducted for each external environment where condensation or moisture on the surfaces of the component could occur routinely or seasonally." It is not clear to the staff that "each external environment" will include each material type and environment as provided in the GALL Report guidance. By letter dated July 7, 2015, the staff issued RAI B.2.1.24-2 requesting that the applicant explain what "each external environment" refers to and provide an exception with justification if any material/environment combination will be exempted.

In its response dated August 6, 2015, the applicant stated that the phrase "external environments" refers to the two environments that concern the program for corrosion under insulation: outdoor air and indoor air. The applicant also stated that inspections for corrosion under insulation will include "all material/environment combinations, and, therefore, no material/environment combinations will be exempted." As a result, the applicant updated LRA Section B.2.1.24 to make the clarification. The staff finds the applicant's response acceptable because, consistent with GALL Report AMP XI.M36, the applicant will inspect for corrosion under insulation on all material/environment combinations and will not take any exemptions to any material/environment combinations. The staff's concern described in RAI B.2.1.24-2 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.2.1.24-1 and B.2.1.24-2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M36.

Operating Experience. LRA Section B.2.1.24 summarizes operating experience related to the External Surfaces Monitoring of Mechanical Components program. The LRA provides several examples related to external surfaces monitoring from 2003 to 2009. In one instance, during a walkdown of the LSCS, Unit 2, service air in 2009, a leaking valve was noticed to have caused material degradation to the equipment below it. This condition was entered into the corrective action program. Actions included an assessment and a repair before loss of intended function of the affected components. Another instance describes that, during operator rounds in 2008, a leaking service water pipe was identified in the Lake Screen House. The condition was entered into the corrective action program. The applicant performed an evaluation and discovered a through-wall leak in the piping. The applicant also performed an extent of condition review on other insulated piping in environments with similar wetting conditions. Repairs were made as appropriate.

The staff reviewed operating experience information in the application during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. 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 evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M36, as modified by LR-ISG-2011-03 and LR-ISG-2012-02, was evaluated.

UFSAR Supplement. LRA Section A.2.1.24 provides the UFSAR supplement for the External Surfaces Monitoring of Mechanical Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff also noted that the applicant committed to implementing the new External Surfaces Monitoring of Mechanical Components program to manage the effects of aging prior to the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring of Mechanical Components program, the staff concludes 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 UFSAR 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 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

Summary of Technical Information in the Application. LRA Section B.2.1.25 describes the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as a new program that is consistent with GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." The LRA states that the program is a condition monitoring program intended to manage the applicable aging effects by directing that visual inspections of internal surfaces of components within the scope of license renewal must be performed when they are made accessible during periodic system and component surveillances or during the performance of maintenance activities. The LRA also states that the program provides assurance that condensation, diesel exhaust, and wastewater environments are not causing material degradation that could result in loss of intended function. The program specifies examination methodology as visual inspections of the internal surfaces of metallic components and other components that are exposed to condensation, diesel exhaust, and wastewater. The program also specifies that acceptance criteria for each component and aging effect combination are defined to ensure that the need for corrective actions is identified.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M38, as modified by LR-ISG-2012-02. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M38.

Operating Experience. LRA Section B.2.1.25 summarizes operating experience related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The LRA provides an example related to corrosion in plant floor drain piping. The LRA states that the program will include periodic inspections of the subject drain systems to ensure that recurring aging effects are adequately managed during the period of extended operation.

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. 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 evaluated and incorporated operating experience related to this program. During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M38, as modified by LR-ISG-2012-02, was evaluated.

UFSAR Supplement. LRA Section A.2.1.25 provides the UFSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff also noted that the applicant committed to implementing the program to manage the effects of aging before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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 concludes 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). Based on its review, the staff concludes that the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Lubricating Oil Analysis

Summary of Technical Information in the Application. LRA Section B.2.1.26 describes the existing Lubricating Oil Analysis program as consistent with the GALL Report AMP XI.M39, Lubricating Oil Analysis program. The LRA states that the AMP addresses loss of material and reduction of heat transfer in piping, piping components, piping elements, heat exchangers, and tanks within the scope of license renewal exposed to a lubricating oil environment. The LRA also states that the AMP proposes to manage these aging effects through a condition monitoring program that provides monitoring of the oil condition.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M.39. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M39.

Operating Experience. LRA Section B.2.1.26 summarizes operating experience related to the Lubricating Oil Analysis program. In May 2010 the applicant performed an oil analysis for the diesel fire pump engine and noted that the trending data indicated an increase in wear particle count (WPC). The applicant entered this into the corrective action program. The applicant used a direct reading ferrograph instrument to measure WPC (i.e., the sum of large particles (Dl) of 5- to 10-μm size plus small particles (Ds) of less than 5-μm size). The WPC value of 104 placed the "A" diesel fire pump engine above the expected WPC value of 100. In the same month, the applicant performed an oil flush and change-out of the lubricating oil for the diesel fire pump engine. In November 2010 the lubricating oil was sampled and analyzed, and again the analysis identified a high WPC. The lubricating oil analysis also indicated higher than expected levels of iron and lead, which are typically associated with cylinder, bearing, or bushing wear. The performance of analytical ferrography validated the lubricating oil analysis sample results. In December 2010 the applicant overhauled this engine and performed another oil flush and change-out of the lubricating oil for the diesel fire pump engine. Subsequent lubricating oil sampling and analyses for the "A" diesel fire pump engine have demonstrated acceptable WPC values and a decreasing trend in WPC.

In August 2007 the applicant performed a lubricating oil analysis of the "B" diesel fire pump engine and identified contamination particulates consisting of small ferrous wear particles, copper wear particles, iron oxide, and sealant material. The applicant entered this into the corrective action program, and an issue report was initiated. Chemical analysis further indicated a higher-than-normal level of sodium, suggesting the presence of engine coolant in the lube oil.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M39 was evaluated.

UFSAR Supplement. LRA Section A.2.1.26 provides the UFSAR supplement for the Lubricating Oil Analysis program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Lubricating Oil Analysis program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Lubricating Oil Analysis program, the staff concludes 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 UFSAR 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 10 CFR Part 50, Appendix J

Summary of Technical Information in the Application. LRA Section B.2.1.32 describes the existing 10 CFR Part 50, Appendix J program as consistent with GALL Report AMP XI.S4, "10 CFR Part 50, Appendix J." The LRA states that the AMP addresses loss of material, loss of leak tightness, and loss of bolting preload in the primary containment and systems penetrating containment. The program also manages loss of sealing due to degradation of containment gaskets and seals. The environments include uncontrolled air-indoor and treated water. The LRA further states that the AMP manages these aging effects through pressure tests performed in accordance with the regulations in Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S4. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the

GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S4.

Operating Experience. LRA Section B.2.1.32 summarizes operating experience related to the 10 CFR Part 50, Appendix J program. The LRA provides the results of the last Type A integrated leak rate test for both units and notes that they were both below the allowable limit. The LRA further discusses an isolation valve that failed a local leak rate test in 2011. The valve was repaired and the subsequent local leak rate test was completed with acceptable results.

The staff reviewed the 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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S4 was evaluated.

UFSAR Supplement. LRA Section A.2.1.32 provides the UFSAR supplement for the 10 CFR Part 50, Appendix J program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing 10 CFR Part 50, Appendix J program for managing the effects of aging for applicable components during the period of extended operation (Commitment No. 32). The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant’s 10 CFR Part 50, Appendix J program, the staff concludes 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 UFSAR 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 Protective Coating Monitoring and Maintenance Program

Summary of Technical Information in the Application. LRA Section B.2.1.36 describes the existing Protective Coating Monitoring and Maintenance Program as consistent with GALL Report AMP XI.S8, “Protective Coating Monitoring and Maintenance Program.” The program is a mitigative and condition monitoring program that manages the effects of loss of coating integrity of Service Level I coatings inside the containment in air-indoor and treated water environments. The program includes coating system selection, application, inspection, assessment, maintenance, and repair for any condition that adversely affects the ability of Service Level I coatings to function as intended. The LRA also states that the program provides controls over the amount of unqualified coating, which is defined as coating inside the primary containment that has not passed the required laboratory testing, including irradiation and simulated design basis accident conditions.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S8. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S8.

Operating Experience. LRA Section B.2.1.36 summarizes operating experience related to the Protective Coating Monitoring and Maintenance Program. The applicant provided the following operating experience. In 2013, during an LSCS, Unit 2, outage, the site coatings coordinator performed inspections of the primary containment drywell and various areas where Service Level I coating repairs were performed. The applicant identified areas for repair and performed coating repairs with qualified Service Level I epoxy coatings. The inspection identified a cap and blind flange in the drywell that required coating; a work order was generated, and the areas were subsequently recoated.

In 2010, during a LSCS, Unit 1, outage, several areas were identified as requiring coating touch-up repairs. The applicant identified various conduit supports, a cable tray support, a tube support, and several liner locations for recoating. The applicant performed the recoating during the following 2012 outage and used approved materials and qualified personnel and procedures.

In 2008, during an LSCS, Unit 1, outage, inspections were performed on coated components in the suppression pool. Several uncoated areas and degraded coatings were identified on the Main Steam Relief Valve (MSRV) struts and welded lugs. These areas were entered into the corrective action program and were evaluated by the site coatings coordinator. The applicant determined that degraded coating on 34 struts was unqualified and entered the struts in the undocumented, unqualified coatings log. The inspections of the MSRV struts and lugs identified minor surface corrosion with no significant loss of material. The applicant indicated that it will continue to monitor the MSRV struts each outage.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S8 was evaluated.

UFSAR Supplement. LRA Section A.2.1.36 provides the UFSAR supplement for the Protective Coating Monitoring and Maintenance Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in

SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Protective Coating Monitoring and Maintenance Program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Protective Coating Monitoring and Maintenance Program, the staff concludes 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 UFSAR 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 Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.37 describes the new Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as consistent with GALL Report AMP XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The LRA states that the Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a condition monitoring program that will be used to manage the effects of reduced resistance of the insulation material for non-EQ cables and connections within the scope of license renewal that are subject to adverse localized environments caused by heat, radiation, and moisture. The program visually inspects accessible cable and connection insulation material located in adverse localized environments at least once every 10 years. Further, the LRA states that cable and connection insulation material is visually inspected for indications of reduced insulation resistance, such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination that could be an incipient conductor, and insulation aging degradation from temperature, radiation, or moisture.

The LRA states that the program will be informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience. The operating experience referenced in the LRA is stated by the applicant to provide objective evidence that the program will be effective in assuring that intended functions are maintained consistent with the CLB for the period of extended operation. The new Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be implemented, and the first inspections 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E1. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E1.

Operating Experience. LRA Section B.2.1.37 summarizes operating experience related to the Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The LRA operating experience discussion includes an example from 1990 in which heat-related aging and degradation of cable insulation material in the feedwater heater bay was identified. The cable insulation material degradation was attributed to the elevated location in the feedwater heater bay space and the cable proximity to steam piping. The cables were evaluated by the applicant and found to be operable. Subsequent corrective actions included the addition of forced ventilation, the insulating of turbine bypass lines and other components, inspections to ensure the cable degradation rate was relatively slow over time, the monitoring of feedwater bay temperatures, and implementation of long-term cable condition monitoring.

Another example discussed in the LRA is an industry operating experience review performed for NRC IN 2010-02, "Construction-Related Experience with Cables, Connectors, and Junction Boxes," dated January 28, 2010. The applicant evaluated IN 2010-02 applicability to LSCS design and construction practices and plant operating experience. The applicant concluded that, based on the its review, including original plant design and construction processes, the improper cable installation practices referenced in IN 2010-02 were not applicable to LSCS.

The LRA includes additional discussion on the performance of cable walkdowns performed in response to Institute of Nuclear Power Operations (INPO) guidance for cable condition monitoring. The walkdowns were performed to identify cables exposed to potentially adverse environment or conditions in the plant. The applicant completed walkdowns in non-outage accessible areas with outage accessible area walkdowns to be performed during future outages. The walkdowns found that cable environments were within their design parameters and that existing conditions were also acceptable.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E1 was evaluated.

UFSAR Supplement. LRA Section A.2.1.37 provides the UFSAR supplement for the Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 37) to implement the new Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program before the period of extended operation. The program and initial visual inspections will be implemented before the period of extended operation and at least once every 10 years thereafter for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program the staff concludes 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 UFSAR 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 Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

Summary of Technical Information in the Application. LRA Section B.2.1.38 describes the new Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program as consistent with GALL Report AMP XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." The LRA states that the Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits is a condition monitoring program that will be used to manage the aging mechanisms and effects of reduced insulation resistance in instrumentation circuits with sensitive, high-voltage, low-level current signals. The LRA includes portions of the Neutron Monitoring System, the Radiation Monitoring System, and the Area Radiation Monitoring System in this program. As stated in the LRA, the following instrumentation circuits are within the scope of the program:

- Neutron Monitoring System
  - source range monitors (SRMs)
  - intermediate range monitors (IRMs)
  - local power range monitors (LPRMs)

- Process Radiation Monitoring System
  - main steam line radiation monitors
  - control room ventilation intake radiation monitors
  - standby gas treatment stack effluent monitor
  - station vent stack wide range gas monitor

- Area Radiation Monitoring System
  - off-gas area radiation monitors

The applicant identified portions of these systems as being located in areas where cables and connections could be subjected to an adverse localized environment caused by temperature, radiation, and moisture, which can result in reduced insulation resistance causing increases in leakage currents. Calibration testing is performed by the program when the cable is included in the calibrated circuit with the calibration results evaluated for indications of aging effects based on calibration acceptance criteria. When the in-scope instrumentation cables are not included as part of the calibration, the LRA stated that a proven cable test, which is effective in determining cable insulation condition, will be performed.

The operating experience referenced in the LRA is stated by the applicant to provide objective evidence that the program will be effective in ensuring that intended functions are maintained consistent with the CLB for the period of extended operation.

The LRA specifies that the new program will be implemented before the period of extended operation, with the first evaluation of calibration/surveillance or cable test results completed before the period of extended operation and performed at least once every 10 years thereafter. The cable test frequency will be based on an engineering evaluation with a test performed at least once every 10 years.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E2. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E2.

Operating Experience. LRA Section B.2.1.38 summarizes operating experience related to the Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program. The LRA operating experience discussion includes an example from February 2010 in which SRM insulation shield to ground resistance was found to be degraded with a possible failure of connector electrical noise isolation. The degraded condition was entered into the corrective action program, and a work order was issued to repair the SRM connector along with two additional connectors. The applicant installed new connectors. Subsequent testing was completed satisfactorily.

An additional example of operating experience occurred in January 2010 in which activities during maintenance identified several Local Power Range Monitor (LPRM) circuits with high shield-to-ground resistance. The applicant determined that technical specification operability requirements continued to be met. The LPRM circuit's high shield-to-ground resistance was entered into the corrective action program and a work order was issued to repair the connectors. Subsequent testing of the LPRM cable circuits indicated satisfactory test results.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E2 was evaluated.

UFSAR Supplement. LRA Section A.2.1.38 provides the UFSAR supplement for the Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 38) to implement the new Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program before the period of extended operation. The first review of calibration/surveillance results or cable test results will be completed before the period of extended operation and at least once every 10 years thereafter. The cable test frequency will be based on an engineering evaluation with a test performed at least once every 10 years for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Insulation Material for Electrical Cables and Connectors Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program, the staff concludes 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 UFSAR 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 Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.39 describes the new Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as consistent with GALL Report AMP XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be used to manage the aging effect of reduced insulation resistance of non-EQ in-scope inaccessible power cables exposed to significant moisture. The LRA defines an inaccessible power cable as greater than or equal to 400 V. The applicant's program will test in-scope inaccessible power cables using one or more proven tests for detecting reduced cable insulation system resistance caused by wetting or submergence. The LRA AMP specifies a test frequency of at least once every 6 years with the first test to be completed before the period of extended operation. The applicant's program adjusts the test frequency based on test results and operating experience. In addition, the LRA AMP will take periodic actions to prevent an in-scope inaccessible power cable from being exposed to significant moisture, including manhole inspections for water collection. The LRA states that the frequency for inspections will be established and adjusted based on plant-specific operating experience and event-driven inspections, such as heavy rain or flooding. The first inspections implemented by the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be completed before the period of extended operation with inspections performed at least annually 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E3. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E3.

Operating Experience. LRA Section B.2.1.39 summarizes operating experience related to the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements 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. 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 evaluated and incorporated operating experience related to this program.

The staff reviewed recent integrated inspection reports for inspection findings concerning in-scope manholes and inaccessible cables. No findings were noted for in-scope manholes or inaccessible power cable submergence. During the audit, the staff reviewed cable vault drawings and performed a walkdown of in-scope manholes for manhole cover integrity and susceptibility to water runoff. The staff reviewed corrective actions and completed work orders, including modifications to install sump pumps in manholes MH5 and MH6 and planned sump pump installation for in-scope manholes MH3 and MH4 to limit water intrusion in these manholes. The staff also reviewed recent in-scope power cable test results, which indicated "satisfactory" for the in-scope inaccessible power cables. The applicant's response to GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," dated February 7, 2007, stated that LSCS had no history of failures of inaccessible or underground power cables within the scope of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," for voltages from 480 V to 15,000 VAC. During the audit, the staff also noted that the LSCS has not experienced any in-scope inaccessible power cable failures after the plant response to GL 2007-01. The applicant provided additional operating experience examples, including the evaluation of applicable industry operating experience; inaccessible cable inspection and testing practices; and corrective actions, including testing; sump pump modifications; cable condition monitoring; periodic manhole inspections; and extent of condition, repair, or replacement. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E3 was evaluated.

UFSAR Supplement. LRA Section A.2.1.39 provides the UFSAR supplement for the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 39) to implement the new Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program initial tests and inspections before the period of extended operation and to perform cable testing at least every 6 years and manhole inspections at least annually for managing the effects of aging for applicable components during the period of extended operation. More frequent test or inspections may occur based on test or inspection results and operating experience. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, the staff concludes 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.20 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B.2.1.41 describes the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as consistent with GALL Report AMP XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The LRA states that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be used to manage increased resistance of connection of the various metals used for electrical contacts in the metallic parts of cable connections exposed to air-indoor, controlled or uncontrolled, or air-outdoor conditions. The LRA also states that the AMP proposes to implement one-time testing of a representative sample of non-EQ electrical cable connections to ensure either that increased resistance of connection does not occur or that the existing preventive maintenance program is effective so that a periodic inspection program is not required. This one-time program will provide additional confirmation to support industry operating experience that shows that electrical connections have not experienced a high degree of failures and that existing installation and maintenance practices are effective. This one-time program will also confirm that there are no aging effects requiring management 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E6. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E6. The staff finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.41 summarizes operating experience related to the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The Non-EQ Cable Connections program is a new program with industry and plant operating experience considered in the implementation of the program. The LRA states that plant operating experience provides objective evidence that the new program will be effective in ensuring that intended functions are maintained consistent with the CLB for the period of extended operation. The LRA states that in August 2013 a hot spot was identified on a single phase on the line side of the breaker for one of the station heating system chillers during routine thermography inspections. The degraded condition was evaluated by the corrective action program, and repairs were made before equipment failure. In another example in June 2013 a thermal anomaly was found during thermography inspections. Followup corrective actions included tightening the bolted terminal connections, and the subsequent thermal imaging indicated that the elevated temperature condition was no longer present.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E6 was evaluated.

UFSAR Supplement. LRA Section A.2.1.41 provides the UFSAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 41) to implement the new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program and one-time test before the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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 concludes 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 UFSAR 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 Environmental Qualification (EQ) of Electric Components

Summary of Technical Information in the Application. LRA Section B.3.1.3 describes the existing Environmental Qualification (EQ) of Electric Components program as an existing preventive program that manages the aging of electrical equipment within the scope of 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." The LRA states that the Environmental Qualification (EQ) of Electric Components program is consistent with the 10 elements of GALL Report AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The LRA states that the program establishes, demonstrates, and documents the level of qualification, qualified configurations, maintenance, surveillance, and replacements necessary to meet 10 CFR 50.49. The LRA also states that the EQ program determines the qualified life for equipment within the scope of the program and that required actions, such as replacement or refurbishment, are implemented before the end of qualified life so that the EQ aging limit of the equipment is not exceeded. The applicant concluded in the LRA that the aging effects addressed by the EQ program are adequately managed so that the intended function(s) of components within the scope of 10 CFR 50.49 are maintained consistent with the CLB during the period of extended operation.

Staff Evaluation. SRP-LR Section 4.4.2.1.3, "10 CFR 54.21(c)(1)(iii)," and GALL Report Chapter X, "Time-Limited Aging Analyses Evaluation of Aging Management Programs under

10 CFR 54.21(c)(1)(iii)," determined that plant EQ programs, which implement the requirements of 10 CFR 50.49, are viewed as an acceptable AMP to address EQ according to 10 CFR 54.21(c)(1)(iii).

During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP X.E1. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP X.E1.

Operating Experience. LRA Section B.3.1.3 summarizes operating experience related to the Environmental Qualification of Electric Components program. The LRA identified plant operating experience examples. A summary of the operating experience is given below.

The applicant referenced a June 2013 Focused Area Self-Assessment (FASA) that was completed for the applicant's EQ program. The applicant stated that the FASA was focused on whether EQ maintenance requirements for motors are consistent with input information from the vendor, relevant corporate and plant maintenance programs, and operating experience. The FASA concluded that the EQ maintenance requirements are consistent with source documentation and industry practice with no deficiencies noted.

The applicant also referenced a FASA performed in May and June 2011 that assessed technical program elements to verify that EQ components are installed and maintained effectively in compliance with EQ documentation. The FASA concluded that the program meets requirements and is satisfactorily implemented at LSCS. The FASA identified recommendations along with six deficiencies that were subsequently corrected.

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. 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 evaluated and incorporated operating experience related to this program.

Operating experience reviewed included the review of quarterly EQ program health reports issued for 2009, 2010, 2011, 2012, and 2013. All health reports reviewed indicate a program rating of "green." The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP X.E1 was evaluated.

UFSAR Supplement. LRA Section A.3.1.3 provides the UFSAR supplement for the Environmental Qualification of Electric Components program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description and TLAA evaluation in SRP-LR Table 4.4-2 and SRP-LR Section 3.6.2.5, "FSAR Supplement," acceptance criteria guidelines. The staff also noted that the applicant committed

(Commitment No. 45) to ongoing implementation of the existing Environmental Qualification of Electric Components program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Environmental Qualification of Electric Components program, the staff concludes 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 UFSAR 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 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:

- Water Chemistry
- Reactor Head Closure Stud Bolting
- BWR Vessel Internals
- Bolting Integrity
- Open-Cycle Cooling Water System
- Closed Treated Water Systems
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Compressed Air Monitoring
- Fire Protection
- Fire Water System
- Aboveground Metallic Tanks
- Fuel Oil Chemistry
- Monitoring of Neutron-Absorbing Materials Other Than Boraflex
- Buried and Underground Piping
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWL
- ASME Section XI, Subsection IWF
- Masonry Walls
- Structures Monitoring
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Metal Enclosed Bus

- Fatigue Monitoring
- Concrete Containment Tendon Prestress

For AMPs that the applicant claimed are consistent with the GALL Report, with one or more exceptions or enhancements, 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 are indeed consistent. The staff reviewed the exceptions to the GALL Report to determine whether they are acceptable and adequate. The staff also reviewed the enhancements to determine whether they will make the AMP consistent with the GALL Report AMP to which it is compared. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 Water Chemistry

Summary of Technical Information in the Application. LRA Section B.2.1.2 describes the existing Water Chemistry program as consistent, with an exception, with GALL Report AMP XI.M2, "Water Chemistry." The LRA states that the AMP addresses the reactor vessel, reactor internals, piping, piping elements, piping components, heat exchangers, and tanks exposed to treated water to manage loss of material, cracking, and reduction of heat transfer. The LRA also states that the AMP proposes to manage these aging effects through periodic monitoring of the treated water and control of known detrimental contaminants, such as chlorides, dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or cracking in accordance with BWRVIP-190, Revision 1, "BWR Vessel and Internals Project, Volume 1: BWR Water Chemistry Guidelines – Mandatory, Needed, and Good Practice Guidance and Volume 2: BWR Water Chemistry Guidelines – Technical Basis," EPRI 3002002623, dated April 24, 2014. Additionally, the LRA states that water chemistry programs may not be effective in low-flow or stagnant-flow areas of plant systems. Therefore, the components located in such areas will receive a one-time inspection as part of the One-Time Inspection program 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M2. The staff also reviewed the portions of the "scope of program" 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 1. LRA Section B.2.1.2 includes an exception to the "scope of program" program element. In this exception the applicant stated that LSCS will be using BWRVIP-190, Revision 1, rather than the GALL Report recommendation of Revision 0. The staff reviewed this exception against the corresponding program elements in GALL Report AMP XI.M2 and finds it acceptable because the more recent revision of BWRVIP-190 incorporates the latest industry operating experience and best practices. Additionally, BWRVIP-190, Revision 1, does not take away or relax any of the BWRVIP-190, Revision 0, recommendations.

Based on its audit of the applicant's Water Chemistry program, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M2. The staff also reviewed the exception associated with the "scope of program" program element and the justification and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.2 summarizes operating experience related to the Water Chemistry program. The applicant described an incident in November 2002 in which chloride concentrations in the reactor coolant exceeded EPRI Action Level 1 limits during an LSCS, Unit 2, startup. The cause of the excursion was quickly identified and concentrations were returned to normal in a timely manner. In an incident in December 2009, the LSCS, Unit 2, suppression pool conductivity, turbidity, and nitrate levels were found to be increased. The applicant determined that this was the result of a suppression pool contamination event that occurred in 2007 and attributed the delay in increased levels to an extended mixing time due to the large volume of the suppression pool. The applicant continued to sample and perform evaluations from the various sample points to ensure that the pool did not have localized contamination or pocketing issues. The applicant stated that these examples provide objective evidence that the Water Chemistry program will be effective in ensuring that the intended functions are maintained for the period of extended operation.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M2 was evaluated.

UFSAR Supplement. LRA Section A.2.1.2 provides the UFSAR supplement for the Water Chemistry program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Water Chemistry program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Water 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 exception and its justifications and determines that the AMP, with the exception, is adequate to manage the applicable aging effects. 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 UFSAR 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 Reactor Head Closure Stud Bolting

Summary of Technical Information in the Application. LRA Section B.2.1.3 describes the existing Reactor Head Closure Stud Bolting program as consistent, with exceptions, with GALL Report XI.M3, "Reactor Head Closure Stud Bolting." The LRA states that it is a condition monitoring and preventive program that includes ASME Code Section XI examinations of reactor head closure studs and associated nuts, washers, bushings, and flange threads to manage cracking and loss of material. The LRA also states that it manages the aging effects in an air-with-reactor coolant leakage environment. The LRA further states that it implements ASME Code Section XI, Subsection IWB, Table IWB-2500-1, inspection requirements with visual and volumetric examinations to monitor for cracking, loss of material, and coolant leakage.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 and aspects of program elements not associated with the exceptions of the applicant's program with the corresponding program elements of GALL Report AMP XI.M3. Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M3.

Exceptions. LRA Section B.2.1.3 states that the applicant reviewed Certified Material Test Reports data of the in-scope components and noted that the yield strength in certain parts are slightly over 150 ksi. The staff reviewed the exceptions associated with the "preventive actions" and "corrective actions" program elements. The staff noted that the GALL Report guidance recommends yield strength of the bolting materials to be lower than 150 ksi. In its review, the staff also noted that the recommendation to use closure bolting with measured yield strength of less than 150 ksi is related to a threshold susceptibility of higher strength materials to SCC. A review of the applicant's justification of the exceptions indicated that the applicant's reactor head closure studs are fabricated from SA-540 Grade B24 material and that nuts and washers are fabricated from SA-540 Grade B23 material with a specified minimum yield strength of 130 ksi and with a minimum tensile strength of 145 ksi. The applicant has appropriately and conservatively assumed that the closure bolting material is susceptible to SCC and performs periodic visual and volumetric examinations in accordance with the ASME Code Section XI. Specifically, to manage cracking due to SCC, the applicant's program includes UT examination of each closure stud during each inspection period. The staff finds that the UT examination provides reasonable assurance that SCC in closure studs will be detected and managed before loss of intended function occurs. Volumetric examinations of the closure studs performed in the past have not indicated any evidence of SCC. In addition, periodic visual examinations will detect other indications of degradation, such as loss of materials, if it occurs. Therefore, the staff finds the applicant's exceptions to the "preventive actions" and "corrective actions" program elements concerning use of material with yield strength equal to or greater than 150 ksi acceptable.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M3. The staff also reviewed the exceptions associated with the "preventive actions" and "corrective actions" program elements and finds them acceptable. The staff finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects during the period of extended operation.

Operating Experience. LRA Section B.2.1.3 summarizes operating experience related to the Reactor Head Closure Stud Bolting program. The applicant provided a few examples related to its plant-specific operating experience. The applicant stated that, during the 2004 LSCS, Unit 1, outage, it performed UT examination of reactor head closure studs and flange threads on Stud Locations 47 through 68 and visually examined all closure nuts and washers at these locations. The applicant also discussed that it performed similar examinations at Stud Locations 1 through 22 in 2008 and Locations 23 through 46 in 2012. In addition, the applicant discussed similar inspections for LSCS, Unit 2, for all locations during the 2007, 2009, and 2011 outages. The applicant further stated that no recordable indications were detected during these inspections.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M3 was evaluated.

UFSAR Supplement. LRA Section A.2.1.3 provides the UFSAR supplement for the Reactor Head Closure Stud Bolting program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implementing the Reactor Head Closure Stud Bolting program during the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Stud Bolting program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff evaluated the exceptions associated with the "preventive actions" and "corrective actions" program elements and determined that the AMP, with the exceptions, is adequate to manage the applicable aging effects. 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 UFSAR 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 BWR Vessel Internals

Summary of Technical Information in the Application. LRA Section B.2.1.9 describes the existing BWR Vessel Internals program as consistent, with enhancements, with GALL Report AMP XI.M9, "BWR Vessel Internals." The BWR Vessel Internals program addresses BWR vessel internal components to manage cracking, loss of material, and loss of fracture toughness through inspection and flaw evaluation in conformance with applicable BWRVIP reports and ASME Code Section XI guidelines. The Water Chemistry program also is used with the BWR

Vessel Internals program to mitigate these aging effects through management of water chemistry. The existing BWR Vessel Internals program includes periodic inspections of X-750 alloy reactor vessel internal components to provide for timely identification of cracks due to thermal aging and neutron irradiation embrittlement. LSCS, Units 1 and 2, do not include any reactor vessel internal components that are fabricated from precipitation-hardened martensitic stainless steel or martensitic stainless steel.

LRA Appendix C lists the following BWRVIP reports that are credited for the BWR Vessel Internals Program:

- BWRVIP-18-R1-A, "BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines"
- BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines"
- BWRVIP-26-A, "BWR Top Guide Inspection and Flaw Evaluation Guidelines"
- BWRVIP-27-A, "BWR Standby Liquid Control System/Core Plate Delta-P Inspection and Flaw Evaluation Guidelines"
- BWRVIP-38, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines"
- BWRVIP-41, "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines (Revision 3)"
- BWRVIP-42-A, "BWR LPCI Coupling Inspection and Flaw Evaluation Guidelines"
- BWRVIP-47-A, "BWR Lower Plenum Inspection and Flaw Evaluation Guidelines"
- BWRVIP-48-A, "Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines"
- BWRVIP-49-A, "Instrument Penetration Inspection and Flaw Evaluation Guidelines"
- BWRVIP-74-A, "BWR Reactor Vessel Inspection and Flaw Evaluation Guidelines for License Renewal"
- BWRVIP-76, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines, Revision 1"

LRA Appendix C also contains the applicant's responses to license renewal applicant action items (AAIs) that were identified in the NRC staff's SEs for the applicable BWRVIP reports. The responses include three license renewal AAIs applicable to all BWRVIP reports and several other license renewal AAIs applicable to specific BWRVIP reports. The staff's evaluation of the applicant's responses to these AAIs is documented in the "Staff Evaluation" subsection for this AMP.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M9. The staff also reviewed the portions of the "scope of program," "parameters monitored or inspected," "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.2.1.9 includes an enhancement to the "scope of program" and "acceptance criteria" program elements. In this enhancement, the applicant stated that cast austenitic stainless steel (CASS) reactor vessel internal components will be evaluated for susceptibility of loss of fracture toughness due to thermal embrittlement. For components that have the material properties that cannot be determined to perform this evaluation, the applicant will assume that the materials are susceptible to thermal aging. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because when it is implemented, it will manage the effects of thermal embrittlement of CASS reactor vessel internal components consistent with the recommendations in the GALL Report to ensure that the intended functions will be maintained during the period of extended operation.

Enhancement 2. LRA Section B.2.1.9 includes an enhancement to the “scope of program” program element. In this enhancement, the applicant stated that CASS reactor vessel internal components will be evaluated for susceptibility of loss of fracture toughness due to neutron embrittlement. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because, when it is implemented, it will manage the effects of neutron embrittlement of CASS reactor vessel internal components consistent with the recommendations in the GALL Report to ensure that the intended functions will be maintained during the period of extended operation.

Enhancement 3. LRA Section B.2.1.9 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements. In this enhancement, the applicant stated that the required periodic inspections will be specified for the CASS reactor vessel internal components that are determined to be susceptible to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement. The initial inspection will be performed before or within 5 years of entering the period of extended operation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because when it is implemented, it will ensure that susceptible CASS vessel internals components will be inspected for evidence of any cracking that could cause failure due to the loss of the material’s fracture toughness caused by thermal or neutron embrittlement.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M9. In addition, the staff reviewed the enhancements associated with the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Enhancement 4. By letter dated January 14, 2016, the applicant supplemented its LRA to include Enhancement 4. In this supplement, the applicant stated that the “scope of program” program element of the BWR Vessel Internals program will be enhanced to install core plate wedges no later than 6 months prior to the period of extended operation, or before the end of the last refueling outage prior to the period of extended operation, whichever occurs later; or, submit an inspection plan for the core plate rim hold-down bolts with a supporting analysis for NRC approval at least 2 years prior to entering the period of extended operation.

The staff noted that this enhancement is associated with the applicant’s response to Action Item 5 in BWRVIP-25, which is evaluated and documented in the Review of License Renewal Applicant Action Items – Appendix C section of this evaluation. The staff reviewed Enhancement 4 against the corresponding program elements in GALL Report AMP XI.M9 and finds it acceptable because (a) it ensures that an analysis justifying its inspection basis to the

NRC, and (b) it ensures that loss of preload/stress relaxation in the core plate rim hold-down bolts will be managed during the period of extended operation. The staff confirmed that when Enhancement 4 is implemented, the applicant's basis will be consistent with the "scope of program" program element in GALL Report AMP XI.M9.

Review of License Renewal Applicant Action Items – Appendix C: The LRA references the BWRVIP reports, which have been reviewed and approved by the staff, as part of its AMPs for the reactor vessel and its internal components. As part of the staff's approval of these BWRVIP reports, the staff's SEs on the reports included a number of license renewal AAIs to ensure that adequate bases are established for applying the reports to the CLB. BWR applicants applying for license renewal of their facilities were requested to include their responses to the AAIs in their LRAs.

Several BWRVIP documents credited for LSCS license renewal have common action items for license renewal in the NRC SEs on the topical reports. The applicant provided the following responses to the three common license renewal action items:

(1) The applicant's BWR Vessel Internals program for the reactor vessel internal components is bounded by the BWRVIP reports.
(2) The applicant's UFSAR supplement addresses a summary of the programs and activities specified in the applicable BWRVIP reports.
(3) No technical specification changes have been identified as a result of implementing the AMP for the reactor vessel internal components.

For the first common license renewal AAI, the staff confirmed that the BWRVIP reports incorporated by the applicant bound the BWR Vessel Internals program.

For the second common license renewal AAI, the staff verified that the LRA includes a UFSAR supplement (LRA Section A.2.1.9) for the BWR Vessel Internals program and that the program summary description adequately explains how the applicable BWRVIP inspection, evaluation, and repair criteria reports will be used to manage aging in the reactor internals at LSCS.

For the third common license renewal AAI, the staff confirmed that the applicant would not need to add any new Technical Specification requirements for the reactor internals or modify any existing Technical Specification requirements that may apply to reactor internal components.

In addition to these three common AAIs, the LRA provides the applicant's responses to the report-specific license renewal AAIs that were specified by the staff in its SEs for BWRVIP reports credited for the BWR Vessel Internals program. The following paragraphs address the staff's evaluation of the applicant's responses to these report-specific AAIs.

For *AAI 4 in BWRVIP-18-A, Revision 1*, the applicant is requested to identify and evaluate any potential TLAA issues that may impact the structural integrity of the subject reactor pressure vessel internal components. The applicant's response states that cumulative fatigue damage was identified and evaluated as a TLAA for core spray piping and components internal to the reactor vessel, as discussed in LRA Section 4.3.4. The staff confirmed that the LRA addresses a TLAA for managing the effects of fatigue on the reactor vessel internals and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Section 4.3.4 is documented in SER Section 4.3.4.

For *AAI 4 in BWRVIP-25*, the applicant is requested to identify and evaluate the projected stress relaxation of the rim hold-down bolts as a potential TLAA issue. The applicant's response states that stress relaxation has been identified and evaluated as a TLAA for reactor pressure vessel core plate rim hold-down bolts, as discussed in LRA Section 4.2.8. The staff confirmed that the LRA addresses a TLAA for managing the effects of loss of preload of these bolts and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Section 4.2.8 is documented in SER Section 4.2.8.

For *AAI 5 in BWRVIP-25,* the applicant is requested to continue to perform inspections of the rim hold-down bolts. By letter dated January 14, 2016, the applicant amended its response to Action Item 5 of BWRVIP-25. In the amended response, the applicant states that inspection of the core plate rim hold-down bolts will be in compliance with BWRVIP guidance prior to and through the period of extended operation. The applicant stated that the BWR Vessel Internals program will be enhanced such that the applicant will either: (a) install core plate wedges no later than 6 months prior to entering the period of extended operation, or (b) submit an inspection plan for the core plate rim hold-down bolts with a supporting analysis for NRC approval at least 2 years prior to entering the period of extended operation. The staff noted that this enhancement is consistent with the program elements of GALL Report AMP XI.M9. The staff finds the applicant's response acceptable because (a) it ensures that an analysis justifying its inspection basis to the NRC, and (b) it ensures that loss of preload/stress relaxation in the core plate rim hold-down bolts will be managed during the period of extended operation.

The staff finds the applicant's response acceptable because compliance with the BWRVIP guidance will ensure that loss of preload/stress relaxation of the core plate rim hold-down bolts will be managed during the period of extended operation.

For *AAI 4 in BWRVIP-26-A*, the applicant is requested to identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue. The applicant's response states that the neutron fluence threshold for irradiation-assisted stress corrosion cracking (IASCC) susceptibility has been exceeded for the reactor vessel internal components. Fluence is identified and evaluated as a TLAA for the reactor vessel internals, as discussed in LRA Section 4.2.1, but no TLAA has been identified to manage the aging effects. The applicant further states that the aging effects of the top guide will be managed by inspections conducted as part of the BWR Vessel Internals program in accordance with the guidance provided in BWRVIP-183. The staff confirmed that, in LRA Table 3.1.2-3, the applicant identified cracking as an applicable AERM for the top guide and uses the BWR Vessel Internals program to manage the aging effect. The staff finds the applicant's response acceptable because the applicant identifies cracking as an applicable aging effect for the top guide components and credits its BWR Vessel Internals program and its BWRVIP-183 inspections for aging management. The staff noted that this approach adequately addresses management of IASCC, which may be induced in the top guide components when the neutron fluence exceeds the threshold defined in BWRVIP-26-A. The staff's evaluation of the BWR Vessel Internals program is documented in this SER section.

For *AAI 4 in BWRVIP-27-A*, the applicant is requested to identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue. The applicant's response states that cumulative fatigue damage was identified and evaluated as a TLAA for the standby liquid control system/core plate dP penetration, as discussed in LRA Sections 4.3.1 and 4.3.3. The staff confirmed that the LRA addresses a TLAA for managing the effects of fatigue on the penetration and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Sections 4.3.1 and 4.3.3 is documented in SER Sections 4.3.1 and 4.3.3, respectively.

For *AAI 4 in BWRVIP-42-A*, the applicant is requested to identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue. The applicant's response states that cumulative fatigue damage was identified and evaluated as a TLAA for the low-pressure coolant injection (LPCI) coupling, as discussed in LRA Section 4.3.4. The staff confirmed that the LRA addresses a TLAA for managing the effects of fatigue on the LPCI coupling and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Section 4.3.4 is documented in SER Section 4.3.4.

For *AAI 5 in BWRVIP-42-A*, the applicant is requested to address the inspection of inaccessible welds in the LPCI nozzle coupling to the reactor vessel and core shroud if referencing BWRVIP-42. The applicant's response states that inspection of the LPCI coupling is performed in accordance with BWRVIP-42-A. The applicant states that portions of the sleeve flange to thermal sleeve weld at the RPV are inaccessible. The applicant inspected similar welds and identified no flaws for either units. The applicant's response states that similar welds will be inspected and will assume leakage from any inaccessible welds if flaws are identified in similar accessible welds. If 75 percent of similar inspectable welds are cracked, the applicant will develop an inspection method to inspect the inaccessible welds. The staff noted that BWRVIP-42-A states that there are no inspection techniques currently available for inaccessible thermal sleeve welds, which is being addressed by the BWRVIP Inspection Committee. The BWRVIP-42-A report further states that the condition of the inaccessible welds can be determined using the conditions of similar inspectable welds. The staff finds the applicant's response acceptable because the applicant can determine the condition of the inaccessible welds using its evaluation of similar inspectable welds and their inspection results, consistent with the guidance in BWRVIP-42-A. The applicant will also develop a plant-specific inspection method for these inaccessible welds, if necessary, before a generic inspection technique is developed by the BWRVIP Inspection Committee.

For *AAI 4 in BWRVIP-47-A*, the applicant is requested to identify and evaluate the projected cumulative usage factor as a potential TLAA issue. The applicant's response states that cumulative fatigue damage was identified and evaluated as a TLAA for the reactor vessel incore instrumentation penetrations and control rod drive penetrations, as discussed in LRA Sections 4.3.1 and 4.3.4. The staff confirmed that the LRA addresses a TLAA for managing the effects of fatigue on these penetrations and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Sections 4.3.1 and 4.3.4 is documented in SER Sections 4.3.1 and 4.3.4, respectively.

For *AAI 4 in BWRVIP-74-A*, the applicant is requested to identify an AMP for the vessel flange leak detection (VFLD) line. The applicant's response states that VFLD nozzles and piping are included in the scope of license renewal. The LSCS, Unit 1, nozzle is made from carbon steel, and the LSCS, Unit 2, nozzle is a penetration made from nickel alloy. The VFLD piping for both units are from carbon steel material. The applicant states that cracking in the Unit 2 nickel alloy nozzle is managed with the ASME Code Section XI ISI program and Water Chemistry program. The staff finds the applicant's use of these AMPs to manage cracking acceptable because the combination of these two programs will adequately identify the aging degradation in a timely manner and because controlling water chemistry will enable the applicant to effectively mitigate the occurrence of any cracking in the VFLD nozzle.

The applicant further stated that loss of material in the carbon steel VFLD piping will be managed using the Water Chemistry program and One-Time Inspection program. The staff finds the use of these programs acceptable because the combination of these two programs will control water chemistry to manage the occurrence of loss of material and will be able to adequately determine whether aging degradation is found. The applicant stated that the carbon steel piping and LSCS, Unit 1, nozzle are not susceptible to cracking, which the staff finds acceptable because SRP-LR Section 3.1.2.2.4.1 identifies only stainless steel and nickel alloy VFLD lines as the material and component combinations susceptible to cracking. The staff's evaluations of the ASME Code Section XI ISI program, Water Chemistry program, and One-Time Inspection program are documented in SER Sections 3.0.3.1.1, 3.0.3.2.1, and 3.0.3.1.9, respectively.

For *AAI 5 in BWRVIP-74-A*, the applicant is requested to describe how each plant-specific AMP addresses the 10 elements of the program. The applicant's response states that there are no plant-specific AMPs credited for managing aging of RPV components and that description of the AMPs credited for managing RPV components are provided in LRA Appendix B. The staff reviewed LRA Appendix B and finds the applicant's response acceptable because the applicant's program in LRA Appendix B adequately addresses the 10 elements of the GALL Report AMP.

For *AAI 6 in BWRVIP-74-A*, the applicant is requested to use water chemistry programs based on monitoring and control guidelines for reactor water chemistry. The applicant's response states that the Water Chemistry program monitors and controls reactor water chemistry in accordance with BWRVIP-190, which supersedes BWRVIP-29. The staff noted that the BWR water chemistry guidelines in BWRVIP-190 represent the updated version of the EPRI BWRVIP water chemistry guidelines in BWRVIP-29 that mitigate that effects of water chemistry on component degradation and aging. The staff noted that the corresponding criteria in BWRVIP-190 implement acceptable water chemistry control practices, including establishment of conservative action levels (i.e., acceptance criteria) for the water chemistry parameters, to perform appropriate corrective actions if those action levels are exceeded. Therefore, staff finds the applicant's response acceptable because (1) the applicant confirmed its conformance with the water chemistry guidelines in BWRVIP-190, (2) the implemented guidelines will provide adequate management of water chemistry at the plant, and (3) the applicant's water chemistry control will effectively prevent or mitigate aging effects on the aging of components (e.g., loss of material due to general, pitting or crevice corrosion, SCC, or IGSCC).

For *AAI 7 in BWRVIP-74-A*, the applicant is requested to identify its reactor vessel material surveillance program. The applicant's response states that LSCS received NRC approval to use the BWRVIP integrated surveillance program (ISP) and applied it to the Reactor Vessel Surveillance program. The staff verified that the applicant's reactor vessel material surveillance program is given in LRA Section B.2.1.20, "Reactor Vessel Surveillance." The staff confirmed that the applicant adequately addressed the action item by stating that the applicant's program is an ISP that complies with the requirements for ISPs in Appendix H to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." The staff finds this response acceptable because the applicant has included its Reactor Vessel Surveillance program in the LRA. The staff's evaluation of the Reactor Vessel Surveillance program and the program's basis for generating relevant reactor vessel embrittlement data for neutron irradiation embrittlement TLAAs is documented in SER Section 3.0.3.1.8.

For *AAI 8 in BWRVIP-74-A*, the applicant is requested to verify that its original fatigue design cycles have been updated to 60 years of operation and address the effects of environmental fatigue. The applicant's response states that fatigue during the period of extended operation, including environmentally assisted fatigue, has been addressed. The staff verified that the applicant has included the metal fatigue evaluations and environmentally assisted fatigue evaluation in LRA Section 4.3. Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluations of the metal fatigue analyses and environmentally assisted fatigue analyses for ASME Code Class 1 and the metal fatigue analyses for non-Class 1 components is documented in SER Section 4.3.

For *AAI 9 in BWRVIP-74-A*, the applicant is requested to demonstrate that the beltline materials meet the Charpy upper-shelf energy (USE) criteria specified in BWRVIP-74-A Appendix B. The applicant's response states that P-T curves were developed, as discussed in LRA Section 4.2.4, and will be updated as required by Appendix G, "Fracture Toughness Requirements," to 10 CFR Part 50. The staff confirmed that the LRA addresses the applicant's TLAA for managing the aging effects associated with P-T limits, as discussed in LRA Section 4.2.4 and, therefore, finds the applicant's response to the AAI acceptable. The staff's evaluation of LRA Section 4.2.4 is documented in SER Section 4.2.4.

For *AAI 10 in BWRVIP-74-A*, the applicant is requested to develop a set of P-T curves for the heatup and cooldown operating conditions during the period of extended operation. The applicant's response states that Charpy USE values for the period of extended operation were determined in accordance with the methodology included in RG 1.99, Revision 2, as discussed in LRA Section 4.2.2. The staff confirmed that the applicant included its TLAA for USE in LRA Section 4.2.2. Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluation of the TLAA for USE is documented in SER Section 4.2.2.

For *AAI 11 in BWRVIP-74-A*, the applicant can obtain relief from the inservice inspection of the circumferential welds during the license renewal period. The applicant's response states that the circumferential welds for each unit will satisfy the limiting conditional failure frequency at the end of the period of extended operation. The applicant's response stated that relief from the inservice inspection of the circumferential welds during the period of extended operation is discussed in LRA Section 4.2.6, which states that an extension of this relief for the period of extended operation will be submitted to the NRC in accordance with 10 CFR 50.55a. The staff confirmed that the applicant included reactor vessel probability of failure analyses (i.e., TLAAs) for the reactor vessel circumferential welds in LRA Section 4.2.6 and will use these TLAAs as the basis for submitting a future inservice inspection relief request for the reactor vessel circumferential welds during the period of extended operation. Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluation of this TLAA is documented in SER Section 4.2.6.

For *AAI 12 in BWRVIP-74-A*, the applicant is requested to monitor axial beltline weld embrittlement. The applicant's response states that the Axial Weld Failure Probability Assessment Analyses have been identified as a TLAA, as discussed in LRA Section 4.2.5. The applicant stated that the TLAA evaluation shows that the mean RTNDT of the limiting axial beltline weld for each unit will be less than the bounding criteria specified in the BWRVIP report at the end of the period of extended operation. The staff confirmed that the applicant included the applicable TLAA for the reactor vessel axial welds in LRA Section 4.2.5. Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluation of the probability of failure analysis TLAA for the reactor vessel axial welds is documented in SER Section 4.2.5.

For *AAI 13 in BWRVIP-74-A*, the applicant is requested to either perform neutron fluence calculations using staff-approved methodology or submit plant-specific methodology for staff review. The applicant's response states that the neutron fluence during the period of extended operation was determined using NRC-approved methodology, as discussed in LRA Section 4.2.1. The staff verified that the applicant has included its neutron fluence calculations for the reactor vessel beltline components (including those in the extended portion of the beltline) in LRA Section 4.2.1 and that the neutron fluence values for these components have been appropriately extended to the end of the period of extended operation (i.e., to 52 EFPY). Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluation of the neutron fluence analysis in LRA Section 4.2.1 is documented in SER Section 4.2.1.

For *AAI 14 in BWRVIP-74-A*, the applicant is requested to re-evaluate indications, evaluated in accordance with ASME Code Section XI to the end of the original operating term, for the period of extended operation. The applicant's response states that there are no components within the ASME Code Class 1 reactor coolant pressure boundary with indications that have been previously analytically evaluated until the end of the 40-year service period. The staff reviewed the LRA and the UFSAR and verified the applicant's claim. Therefore, the staff finds the applicant's response to the AAI acceptable.

For *AAI 4 in BWRVIP-76, Revision 1*, the applicant is requested to reference BWRVIP-14-A, BWRVIP-99-A, and BWRVIP-100-A in its evaluation procedures for cracked core shroud welds in the reactor vessel internals AMP and to confirm that it will incorporate any emerging inspection guidelines. The applicant's response states that the BWR Vessel Internals program references these BWRVIP reports, specifies that the crack growth rate evaluations and fracture toughness values in the reports will be used, and confirms that emerging inspection guidelines will be incorporated into the program. The staff verified that the applicant has included these BWRVIP reports as part of the methodologies that will be applied in accordance with the BWR Vessel Internals program. Therefore, the staff finds the applicant's response to the AAI acceptable.

For *AAI 5 in BWRVIP-76, Revision 1*, the applicant is requested to incorporate the tie rod cracking operating experience at Hatch 1 into its AMPs. The applicant's response states that the core shrouds at both units have not been modified to include tie rod repairs. The staff reviewed the UFSAR and verified that the applicant has yet to implement any core shroud modifications associated with the installation of tie rod repair assemblies. Therefore, the staff finds the applicant's response to the AAI acceptable because the staff reviewed the UFSAR and confirmed that the core shroud designs do not include tie rod repair assemblies.

For *AAI 6 in BWRVIP-76, Revision 1*, the applicant is requested to identify the aging effects for the core shrouds and core shroud assembly components if a repair design modification has been implemented and to identify the specific AMPs or TLAAs that will be used to manage the effects for the period of extended operation. The applicant's response states that cumulative fatigue damage, cracking, and loss of material have been identified as aging effects requiring management for the core shrouds. The BWR Vessel Internals program and Water Chemistry program will be used to manage cracking and loss of material, and the Fatigue Monitoring program will be used to manage cumulative fatigue damage. The staff reviewed the LRA and confirmed that these aging effects have been identified and will be managed during the period of extended operation. Therefore, the staff finds the applicant's response to the AAI acceptable. The staff's evaluations of the BWR Vessel Internals program, the Water Chemistry program, and the Fatigue Monitoring program are documented in SER Sections 3.0.3.2.3, 3.0.3.2.1, and 3.0.3.2.22, respectively.

For *AAI 7 in BWRVIP-76, Revision 1*, the applicant is requested to identify and manage applicable aging effects for core shroud components or core shroud repair assembly components that are made from materials other than stainless steel or nickel alloy. The applicant's response states that this is not applicable because the core shrouds, including welds, are fabricated from stainless steel and nickel alloy and that no core shroud repair assembly components have been added. The staff finds this acceptable because the staff reviewed the UFSAR and confirmed the applicant's response.

For *AAI 8 in BWRVIP-76, Revision 1*, the applicant is requested to reference BWRVIP-99 and BWRVIP-100-A in its reactor vessel internals AMP. The applicant's response states that these two BWRVIP reports are referenced in the BWR Vessel Internals program. The staff confirmed these BWRVIP documents are referenced in the applicant's program and, therefore, finds the applicant's response to the AAI acceptable.

<u>Operating Experience</u>. LRA Section B.2.1.9 summarizes operating experience related to the BWR Vessel Internals 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. As discussed in the Audit Report, the staff also conducted an independent search of the plant operating experience information to determine whether the applicant had adequately evaluated and incorporated operating experience related to this program.

The staff noted that the applicant has identified relevant plant-specific operating experience. The LRA states that in 2004, all of the LSCS, Unit 1, jet pump riser brace RS-8 and RS-9 welds were visually inspected, and indications were noted. As a result, corrective actions were initiated, and a clamp was installed at the slip joint on all 20 jet pumps. The staff noted that BWRVIP-41 and industry sources discuss operating experience related to degradation due to jet pump vibration. However, the LRA does not clearly address whether the applicant's program resolved the concern about jet pump vibration resulting from slip joint leakage flow instability, pump resonance, or turbulent flow. The LRA does not address assessment of plant-specific operating experience regarding jet pump vibration and loss of material due to wear of jet pump wedges and restrainer brackets at their interfaces. The staff needed additional information to determine whether the program needs to be enhanced with additional aging management activities and inspections based on adequate assessment of operating experience.

By letter dated June 8, 2015, the staff issued RAI B.2.1.9-1, requesting the applicant to (1) discuss how the applicant's program resolved the concern about jet pump vibration for LSCS, Units 1 and 2, and (2) provide the assessment of plant-specific operating experience regarding jet pump vibration and loss of material due to wear of jet pump wedges and restrainer brackets at their interfaces, including a justification for why the BWR Vessel Internals program would not need to be enhanced.

By letter dated July 1, 2015, the applicant responded to RAI B.2.1.9-1. For LSCS, Unit 1, the applicant stated that it mitigated vibration caused by leakage at the jet pump slip joints through the installation of slip joint clamps. The applicant confirmed that the slip joint clamp installations arrested the vibration caused by slip joint leakage flow instability. The applicant also installed riser brace clamps to structurally replace the RS-9 welds. The applicant re-examined the indications found on the RS-9 welds and found no change, which indicates that vibration has been mitigated. For LSCS, Unit 2, the applicant stated that the jet pump inlet mixers were replaced with inlet mixers that have a labyrinth seal design, which reduces vibration through increases in the slip joint differential pressure. The applicant stated that no indications have been identified in the LSCS, Unit 2, RS-9 welds. The staff finds this portion of the applicant's response acceptable because the applicant performed adequate corrective actions, consistent with the guidance in BWRVIP-41, to mitigate the degradation due to jet pump vibration and because post-corrective action examinations have determined that wear rates of the jet pump components have been reduced or ceased.

In its response to RAI B.2.1.9-1, the applicant also stated that a program enhancement to the BWR Vessel Internals program was not identified to manage jet pump degradation due to jet pump vibration because the corrective actions, examination techniques, and criteria for scope expansion are performed in accordance with BWRVIP-41. The applicant further stated that, because the BWR Vessel Internals program references BWRVIP-41 and because it will implement any revisions to this report, no enhancement is necessary to the AMP. In addition, to address operating experience associated with main wedge wear, the applicant has incorporated industry guidance and operating experience into its BWR Vessel Internals program, which includes BWRVIP Letter 2014-019 and General Electric-Hitachi Safety Communications 12-12 and 12-14. These industry sources contain examination criteria, scope expansion criteria, and re-examination requirements. The staff finds this portion of the applicant's response acceptable because (1) the applicant has already incorporated the guidance in BWRVIP-41 and industry guidelines in the BWR Vessel Internals program and (2) the applicant will continue to evaluate future plant-specific and industry operating experience and incorporate industry guidelines to ensure that aging is effectively managed for the jet pump components during the period of extended operation. The staff's concerns in RAI B.2.1.9-1 are resolved.

Based on its audit and review of the application and review of the applicant's response to RAI B.2.1.9-1, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M9 was evaluated.

UFSAR Supplement. LRA Section A.2.1.9 provides the UFSAR supplement for the BWR Vessel Internals program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to (1) evaluate CASS reactor vessel internals components for susceptibility to thermal embrittlement before the period of extended operation, (2) evaluate CASS reactor vessel internals components for susceptibility to neutron embrittlement before the period of extended operation and (3) specify the required periodic inspection of CASS components susceptible to loss of fracture toughness due to thermal and neutron embrittlement before or within 5 years of entering the period of extended operation.

By letter dated January 14, 2016, the applicant amended its UFSAR supplement to include Enhancement 4, which states that the applicant will either (a) install core plate wedges no later than 6 months prior to entering the period of extended operation, or (b) submit an inspection plan for the core plate rim hold-down bolts with a supporting analysis for NRC approval at least two years prior to entering the period of extended operation.

The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's BWR Vessel Internals 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 before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Bolting Integrity

Summary of Technical Information in the Application. LRA Section B.2.1.11 describes the existing Bolting Integrity program as consistent, with enhancements, with GALL Report AMP XI.M18, "Bolting Integrity." The LRA states that the AMP manages the aging effects of cracking, loss of material, and loss of preload of closure bolting for pressure-retaining components within the scope of license renewal. The AMP implements the GALL Report recommended guidance in NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," dated June 1990; EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants"; and EPRI TR-104213, "Bolted Joint Maintenance and Applications Guide," for material selection, use of lubricants, proper torqueing, and leakage evaluations. The AMP also relies on periodic visual inspections, performed at least once every RFO, to detect signs of leakage and age-related degradation of pressure-retaining closure bolts in ASME Code and non-ASME Code Section XI, Class 1, 2, and 3 systems. Volumetric inspections of ASME Section XI Class 1, 2, and 3 bolts, nuts, and washers are performed in accordance with ASME Section XI, Subsections IWB, IWC, and IWD.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M18.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "corrective actions" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. By letter dated July 7, 2015, the staff issued RAI 3.2.2.1.1-1 requesting the applicant to justify the aging management inspection parameters and frequency of inspection of submerged bolts in the suppression pool emergency core cooling system (ECCS), reactor core isolation cooling (RCIC) system suction strainers, the service water diver safety barriers, and diesel fire pump suctions screens. The RAI also requested that the applicant justify the aging management inspection parameters of submerged bolts in the lake screen house traveling screens framework. The staff's discussion of its concern and review of the applicant's response to RAI 3.2.2.1.1-1, dated August 6, 2015, are documented in SER Sections 3.2.2.1.2 and 3.3.2.1.5. The submerged bolts discussed in RAI 3.2.2.1.1-1 are also associated with Enhancements 4, 5, and 6 of this AMP. The staff's evaluation of the enhancements to the Bolting Integrity program, as revised by the applicant's response to RAI 3.2.2.1.1-1, follows.

Enhancement 1. LRA Section B.2.1.11 includes an enhancement to the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "corrective actions," program elements. In this enhancement, the applicant stated that it will implement guidance in the AMP to "ensure proper specification of bolting material, lubricant and sealants, storage, and installation torque or tension to prevent or mitigate degradation and failure of closure bolting for pressure-retaining bolted joints." The GALL Report AMP XI.M18 "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "corrective actions" program elements recommend the implementation of the guidelines in EPRI-NP 5769, NUREG-1339, and EPRI TR-104213 to prevent and mitigate degradation and failure of closure bolting. During the AMP audit, the staff reviewed the Bolting Integrity program basis document and existing procedures. As part of its review, the staff verified that the guidelines recommended by the GALL Report AMP XI.M18 were either already included in the existing procedures or were identified in the program basis document as guidelines to be added to the procedures before the period of extended operation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because, when it is implemented, the guidelines recommended by GALL Report AMP XI.M18 for selection of bolting material, use of lubricants, storage, and application of proper torque will be incorporated into the Bolting Integrity program.

Enhancement 2. LRA Section B.2.1.11 includes an enhancement to the "preventive actions" and "corrective actions" program elements. In this enhancement, the applicant stated that the use of molybdenum disulfide (MoS_2) lubricants on pressure-retaining bolts will be prohibited. The "preventive actions" program element of GALL Report AMP XI.M18 states that lubricants containing MoS_2 should not be used because MoS_2 has been shown to be a potential contributor to SCC. The "corrective actions" program element of GALL Report AMP XI.M18 recommends that the replacement of ASME and non-ASME Code Class pressure-retaining bolting be performed consistent with the guidance in EPRI NP-5769 and EPRI TR-104213. The staff notes that the guidance in EPRI NP-5769 states that a common factor in the failure of closure bolting due to SCC appears to be the use of lubricants containing MoS_2. In addition, EPRI TR-104213 states, in part, that the use of lubricants containing sulfides (e.g., MoS_2) is undesirable because it contributes to SCC. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because, when it is implemented, the use of MoS_2 will be prohibited to prevent the aging effect of SCC in closure bolts, consistent with the recommendations in the GALL Report AMP XI.M18.

Enhancement 3. LRA Section B.2.1.11 includes an enhancement to the "preventive actions," "parameters monitored or inspected," and "corrective actions" program elements. In this enhancement, the applicant stated that the use of high-strength bolts (actual yield strength greater than or equal to 150 ksi) will be minimized and that it will monitor high-strength bolts (regardless of code classification) for cracking in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1. The "preventive actions" program element of GALL Report AMP XI.M18 recommends using bolting material with an actual measured yield strength limited to less than 150 ksi. The GALL Report AMP XI.M18 also recommends monitoring high-strength bolting with actual yield strength greater than or equal to 150 ksi for cracking and performing volumetric examination of high-strength closure bolts (regardless of code classification) in accordance with ASME Code Section XI, Table IWB-2500-1, Examination Category B-G-1, to detect cracking. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because the use of high strength bolts will be minimized, and if high-strength bolting with actual yield strength greater than or equal to 150 ksi is installed, it will be subject to volumetric examinations to detect cracking due to SCC before a loss of intended function.

Enhancement 4. LRA Section B.2.1.11 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that inspections for loss of material and loss of preload of the submerged bolting in the suppression pool ECCS and RCIC system suction strainers will be performed during each ISI interval (i.e., once every 10 years). By letter dated August 6, 2015, the applicant clarified that these inspections will consist of visual inspections of 100 percent of the accessible surfaces of bolt heads, nuts, and threaded bolt shank beyond the nut and physical manipulation of the nuts to ensure that the nuts are not loose.

The GALL Report AMP XI.M18 recommends that closure bolting be inspected for loss of material and loss of preload. The GALL Report also recommends that for components that are not accessible, visual inspections should be conducted at a frequency not to exceed 10 years. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because visual inspection of 100 percent of the accessible bolts and physical manipulation of the nuts at a 10-year frequency provides reasonable assurance that the effects of aging on the suppression pool ECCS and RCIC system suction strainers bolting will be adequately managed because, in all instances, the accessible and inaccessible bolting are exposed to the same environment.

Enhancement 5. LRA Section B.2.1.11 includes an enhancement to "parameters monitored or inspected," and "detection of aging effects" program elements. In this enhancement, the applicant stated that the submerged bolts in the service water diver safety barriers and diesel fire pump suction screens will be subject to inspection for loss of material and loss of preload once every RFO interval. By letter dated August 6, 2015, the applicant clarified that these inspections will consist of visual inspections of 100 percent of the accessible surfaces of bolts and physical manipulation of the nuts to ensure that the nuts are not loose. GALL Report AMP XI.M18 recommends that closure bolting is inspected for loss of material and loss of preload. The GALL Report also states that pressure-retaining bolted connections should be inspected at least once per refueling cycle. The staff finds that performing these inspections provides reasonable assurance that the effects of aging of the inaccessible bolting in the service water diver safety barriers and diesel fire pump suctions screens will be adequately managed because, in all instances, the accessible and inaccessible bolting are exposed to the same environment. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because when it is implemented, visual inspections for loss of material and loss of preload for service water diver safety barriers and diesel fire pump suctions screens will be performed once every RFO consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 6. LRA Section B.2.1.11 includes an enhancement to "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that inspection for loss of material and loss of preload of the submerged bolting in the lake screen house traveling screens framework will be performed once every RFO interval. By letter dated August 6, 2015, the applicant clarified that these inspections will consist of visual inspections of 100 percent of the accessible surfaces of bolts and physical manipulation of the nuts to ensure that the nuts are not loose. GALL Report AMP XI.M18 recommends that closure bolting be inspected for loss of material and loss of preload. The GALL Report also states that pressure-retaining bolted connections should be inspected at least once per RFO. The staff finds that performing these inspections provides reasonable assurance that the effects of aging of the inaccessible bolting in the lake screen house traveling screens framework will be adequately managed because, in all instances, the accessible and inaccessible bolting are exposed to the same environment. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because, when it is implemented, visual inspections for loss of material and loss of preload for the lake screen house traveling screens framework will be performed once every RFO consistent with the recommendations in GALL Report AMP XI.M18.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M18. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "corrective actions" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.11 summarizes operating experience related to the Bolting Integrity program. In January 2002, during maintenance of the internals for the reactor recirculation "A" loop flow control valve, 1 of 12 studs failed due to overtorquing. The applicant entered the condition into its corrective action program and performed UT and magnetic particle (MT) examinations of the remaining 11 studs. Based on the examination results the applicant found cracking on 10 of the 11 remaining studs and determined that the cracking was present before the overtorquing failure. The applicant replaced all bonnet-to-body studs. Additional corrective actions taken included performing UT examinations on the corresponding "B" loop valve studs; examining both LSCS, Units 1 and 2, valve studs for which no cracks were identified; incorporating Belleville washers into the bolted joint design; and implementing enhancements to the personnel training and work procedures in the use of hydraulic torque wrenches.

In February 2010, the applicant identified corrosion in the bolting and end cover of a cooling water strainer. The corrosion was caused by a packing leak from the strainer manual backwash valve. Corrective actions taken by the applicant included entering the condition into the corrective action program, reworking the bolted joint, replacing bolting hardware if needed, performing walkdowns of the remaining strainers in the system, replacing and reconfiguring strainers to prevent recurrence of the condition, and performing periodic inspections to identify corrosion and packing leaks.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M18 was evaluated.

UFSAR Supplement. LRA Section A.2.1.11, as revised by letter dated August 6, 2015, provides the UFSAR supplement for the Bolting Integrity program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancement to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Open-Cycle Cooling Water System

Summary of Technical Information in the Application. LRA Section B.2.1.12 describes the existing Open-Cycle Cooling Water System program as consistent, with enhancements, with GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." The LRA states that the program manages heat exchanger and piping components of safety-related and nonsafety-related systems exposed to a raw water environment. Activities for the program are consistent with the commitments to NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989, and include system surveillances and chemical injections to manage biofouling; periodic testing, visual inspections, and cleaning of heat exchangers to manage reduction of heat transfer; and inspections and routine maintenance of components to manage corrosion, erosion, sediment deposition, and biofouling.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M20.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" 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.2.1.12 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that a minimum of 10 inspections will be performed on aboveground piping in the essential cooling water system every 24 months until the rate of degradation due to microbiologically-influenced corrosion no longer meets the recurring internal corrosion criteria given in LR-ISG-2012-02. The enhancement includes periodic reviews of the selected inspection locations to validate their relevance and to make adjustments as appropriate. A portion of the samples for this enhancement will be at locations with similar process conditions to those in the buried portions of the piping to provide sufficient understanding of the buried piping condition. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M20, as modified by LR-ISG-2012-02, and finds it acceptable because, when it is implemented, the program's additional inspections will improve the aging management of recurring internal corrosion due to microbiologically-influenced corrosion in the safety-related portions of the open-cycle cooling water system.

Enhancement 2. LRA Section B.2.1.12 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that a minimum of 10 inspections will be performed on aboveground piping in the nonessential cooling water system every 24 months until the rate of degradation due to microbiologically-influenced corrosion no longer meets the recurring internal corrosion criteria given in LR-ISG-2012-02. The enhancement includes periodic reviews of the selected inspection locations to validate their relevance and to make adjustments as appropriate. A portion of the samples for this enhancement will be at locations with similar process conditions to those in the buried portions of the piping to provide sufficient understanding of the buried piping condition. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M20, as modified by LR-ISG-2012-02, and finds it acceptable because, when it is implemented, the program's additional inspections will improve the aging management of recurring internal corrosion due to microbiologically-influenced corrosion in the nonsafety-related portions of the open-cycle cooling water system.

Enhancement 3. LRA Section B.2.1.12 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that an inspection method to provide an indication of wall thickness will be selected to examine buried piping to supplement the aboveground piping inspection locations. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M20, as modified by LR-ISG-2012-02, and finds it acceptable because additional inspections of buried piping will augment the information derived from the aboveground piping inspections and will provide better management of recurring internal corrosion due to microbiologically-influenced corrosion.

Enhancement 4. LRA Section B.2.1.12 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that visual inspections will be performed on the interior surface of buried portions of the essential and nonessential cooling water systems whenever the piping internal surfaces are accessed during maintenance or repair activities. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M20, as modified by LR-ISG-2012-02, and finds it acceptable because, when it is implemented, the program will provide additional inspections to better manage recurring internal corrosion due to microbiologically-influenced corrosion.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M20, as modified by LR-ISG-2012-02. The staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.12 summarizes operating experience related to the Open-Cycle Cooling Water System program. The applicant described the identification and subsequent replacement of degraded seal cooler piping during a periodic wall thickness inspection that was conducted as part of the GL 89-13 program. Based on the finding, additional locations were selected for inspections. The applicant also described the identification and resolution of low-flow issues from periodic surveillance tests in the core standby cooling system. The associated common cause evaluation recommended improvements to the program that addressed more frequent and higher flow rate flushing, expansion of the chemical cleanout of coolers to include connected piping, and increased concentrations of chemicals used for silt dispersion and biofouling.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M20 was evaluated.

UFSAR Supplement. LRA Section A.2.1.12 provides the UFSAR supplement for the Open-Cycle Cooling Water System program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the four enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR is an adequate summary description of the program.

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 that the applicant claimed were consistent with the GALL Report are consistent with AMP XI.M20. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CRF 54.21(d).

3.0.3.2.6 Closed Treated Water Systems

Summary of Technical Information in the Application. LRA Section B.2.1.13, as modified by letter dated August 6, 2015, describes the existing Closed Treated Water Systems program as consistent, with enhancements, with GALL Report AMP XI.M21A "Closed Treated Water Systems," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." The program manages loss of material, cracking, and reduction of heat transfer in components exposed to closed cycle cooling water. The program provides mitigative measures and monitors water chemistry parameters based on EPRI 1007820, "Closed Cooling Water Chemistry Guideline," and uses nitrite-based water treatment, including pH control and corrosion inhibitors. The program includes opportunistic and periodic visual inspections or nondestructive examinations to identify the presence of corrosion, SCC, or fouling to prevent significant age-related degradation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M21A. For the "parameters monitored or inspected" and "detection of aging effects" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "detection of aging effects" program element in GALL Report AMP XI.M21A recommends that a representative sample of piping and components be inspected. Although the applicant stated that the program will be enhanced to include periodic inspections and nondestructive examinations of a representative sample, the LRA and onsite documentation did not include any details relating to the sample size. The staff noted that this was inconsistent with the guidance in SRP-LR Section A.1.2.3.4, "Detection of Aging Effects," in that the basis for the sample size should be provided whenever sampling is used to represent a larger population of components. To address this concern, by letter dated July 7, 2015, the staff issued RAI B.2.1.13-1, requesting that the applicant provide details related to the size of the representative sample associated with the enhancement to the program.

In its response dated August 6, 2015, the applicant stated that due to the small number of stainless steel components in the "closed cycle cooling water greater than 140 °F" environment, the sample will consist of 20 percent of the components in each unit. For the "closed cycle cooling water" environment, each sample will consist of 25 components. The applicant stated that the inspection locations will be selected based on the likelihood of age-related degradation and that the repetitive tasks to perform these inspections will have a frequency interval not to exceed once every 10 years. The staff notes that the program currently includes opportunistic visual inspections of components whenever a closed cycle cooling water system boundary is opened. The staff finds the applicant's response acceptable because the proposed sample size of 20 percent or 25 components is consistent with guidance provided in other GALL Report AMPs that use sampling. The staff's concern described in RAI B.2.1.13-1 is resolved.

During its reviews related to the "detection of aging effects" program element, the staff noted that the only components being managed for reduction of heat transfer by this AMP were heat exchanger tubes in LRA Table 3.3.2-8, "Diesel Generator and Auxiliaries System." The staff also noted that the heat exchanger tubes for the drywell penetration cooling coils in LRA Table 3.3.2-1, "Closed Cycle Cooling Water System," are not being managed for reduction of heat transfer because the cooling provided to the drywell penetrations does not need to be credited for license renewal. In that regard, the staff noted that AMR item 3.5.1-3, associated with aging management of concrete exposed to elevated temperatures, is designated as "not applicable" because localized concrete temperatures greater than 200 °F have not been reported. The staff noted that, although cooling of the drywell penetrations may not be required to be credited, cooling provided by the drywell penetrations coils is the reason why localized concrete temperatures greater than 200 °F were not reported. It was unclear to the staff how aging effects related to elevated temperatures adjacent to the drywell penetrations could be considered not applicable unless heat transfer for the associated cooling coils was being managed. By letter dated July 7, 2015, the staff issued RAI B.2.1.13-2, requesting that the applicant either identify the activities that will be credited for ensuring local temperatures will be maintained less than 200 °F or provide the plant-specific AMP described in SRP-LR, item 3.5.1-3, for managing reduction of strength and modulus for concrete due to elevated temperatures.

In its response dated August 6, 2015, the applicant stated that the penetration cooling coils prevent heat-induced degradation of the local concrete surrounding the penetrations during normal modes of reactor operation. Although the applicant did not consider this preventive measure as a license renewal intended function, it recognized the need to ensure that this preventive measure is maintained. Consequently, the applicant revised LRA Sections A.2.1.13 and B.2.1.13 to include an enhancement to the Closed Treated Water Systems program to perform monthly monitoring and trending of the cooling coil outlet temperatures to ensure adequate cooling is being provided to the concrete adjacent to the drywell penetrations. The staff finds the applicant's response acceptable because the enhancement to the Closed Treated Water Systems program will ensure that the preventive measure provided by cooling the concrete adjacent to the drywell penetrations will be maintained during the period of extended operation. The staff's concern described in RAI B.2.1.13-2 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" 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.2.1.13 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that condition monitoring, including visual inspections and nondestructive examinations, will be performed on a representative sample of piping and components at an interval not to exceed 10 years. Aspects of this enhancement were the subject of RAI B.2.1.13-1 and are discussed above. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M21A and, as discussed above, finds this enhancement acceptable because inspecting a representative sample of piping and components exposed to closed cycle cooling water is consistent with the GALL Report AMP.

Enhancement 2. As modified by letter dated August 6, 2015, LRA Section B.2.1.13 includes an enhancement to the "parameters monitored or inspected" and "monitoring and trending" program elements. In this enhancement, the applicant stated that drywell penetration cooling coil outlet temperatures will be monitored and trended monthly to ensure that adequate cooling is being provided to the concrete adjacent to the drywell penetrations. This enhancement resulted from RAI B.2.1.13-2, and, as discussed above, the staff finds this enhancement acceptable because it will ensure that the preventive measure provided by cooling the concrete adjacent to the drywell penetrations will be maintained during the period of extended operation.

Based on its audit and review of the applicant's responses to RAIs B.2.1.13-1 and B.2.1.13-2, the staff finds that the program elements 1 through 6, for which the applicant claimed consistency with the GALL Report, are consistent with the corresponding program elements of GALL Report AMP XI.M21A. The staff also reviewed the enhancements associated with the "parameters monitored or trended," "detection of aging effects," and "monitoring and trending" program elements and their justifications and finds that, when implemented, they will make the AMP adequate to manage the aging effects.

Operating Experience. LRA Section B.2.1.13 summarizes operating experience related to the Closed Treated Water Systems program. The applicant identified an issue in 2003 with the pH and ammonia levels during routine sampling of the containment chilled water system and required chemical adjustments to bring chemistry parameters within acceptance limits. Although this eventually resolved the issue, as part of the corrective action process, chemistry personnel assessed the need for multiple chemical additions, concluded that the current biocide may not be effective, and identified an acceptable alternative biocide based on EPRI guidance and benchmarking at another station. The applicant also identified an issue in 2010 with low nitrite levels in the turbine building closed cooling water system. After a repeat occurrence following chemical adjustments, the applicant determined that a system leak in the supply to the station air compressor resulted in frequent water makeup, causing the nitrite level to be outside its acceptance limit. Corrective actions to repair the leak and to restore chemistry within acceptance limits appropriately resolved the issue.

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. 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 evaluated and incorporated operating experience related to this program. The staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of RAIs, as discussed below.

During its review of plant-specific operating experience, the staff noted that AR00299270, AR00200440, and AR00200183 identified cracking in heat exchanger tubes associated with the reactor recirculation pump motor coolers. However, the heat exchanger tubes and tube side components for the motor coolers in LRA Table 3.1.2-1, "Reactor Coolant Pressure Boundary System," did not identify cracking as an aging effect being managed for these components. By letter dated July 7, 2015, the staff issued RAI B.2.1.13-3, requesting that the applicant either provide the technical bases to show that cracking does not need to be managed for these components or provide additional AMR items that address cracking.

In its response dated August 6, 2015, the applicant stated that the three operating experience reports cited in the RAI related to a single event from 2004. The applicant also stated that following eddy current testing, inspection, and analysis by industry experts, the cracking was determined to originate from the external surface of the tubes, which is exposed to air not cooling water. The analysis concluded that the degradation was due to external contamination introduced through manufacturing practices or through inadequate storage practices before installation. The applicant's corrective and extent of condition actions included nondestructive examinations of all reactor recirculation pump motor coolers and repairs to any tubes as indicated by eddy current results.

During its review of the above issue, the applicant determined that the material for the reactor recirculation pump cooler tubes was copper alloy greater than 15-percent zinc instead of less than 15-percent zinc, as originally shown in LRA Table 3.1.2-1. Consequently, the applicant revised LRA Table 3.3.1, item 3.3.1-72, and LRA Table 3.1.2-1 to reflect the change in material and to add cracking and selective leaching as aging effects requiring management. The applicant also performed an extent of condition review and identified similar errors for the specified materials in tanks and valve bodies for the fire protection system. The applicant revised LRA Table 3.3.2-12 to correct the identified inconsistencies. The staff finds the response acceptable because the applicant will ultimately manage cracking of the reactor recirculation pump motor coolers based on the revised tube material. Even though the operating experience reports involved external cracking, aging management of cracking for tube internal surfaces will require additional eddy current testing that, as the applicant has demonstrated, is able to identify cracking initiated on the external surfaces of the tubes. In addition, the staff considers the applicant's extent of condition reviews to identify comparable cracking in the other pump motor coolers and to identify comparable inconsistencies in the tube materials to be reasonable corrective actions. The staff's concerns described in RAI B.2.1.13-3 are resolved.

In consideration of industry operating experience related to this program, the staff reviewed the applicant's evaluation associated with Licensee Event Report 263/2014-01, "Primary System Leakage Found in Recirculation Pump Upper Seal Heat Exchanger." The event report addresses cracking in a stainless steel heat exchanger tube caused by unrecognized localized boiling that led to an unexpectedly high concentration of chlorides from the chemistry constituents in the reactor building closed cooling water system. The applicant's evaluation of the event report states that the heat exchanger configuration at LSCS (describe as "a tube within a tube," as compared to the "tube within a box" described in the licensee event report) does not allow similar chloride concentrations and that, because the heat exchanger is external to the pump, it is visually inspected at each outage. In its review of the applicant's evaluation, the staff was concerned that a similar heat exchanger configuration would allow similar chloride concentrations and that visual inspections during the outage could not detect cracking of the interior tube. By letter dated July 7, 2015, the staff issued RAI B.2.1.13-4 requesting the applicant to provide an assessment of the operating experience evaluation discussed above.

In its response dated August 6, 2015, the applicant stated that, although LSCS's recirculation pump seal coolers have a similar configuration to the coolers described in the licensee event report, other design differences minimize the probability of this type of event from occurring at LSCS. The critical difference is that the recirculation pump seal water is not reactor water; instead, it is seal purge water from the control rod drive system, which is less than 140 °F during normal operation. This is well below the boiling point of the reactor building closed cooling water system, and chloride concentration, as described in the licensee event report, cannot occur.

However, as part of its evaluation, the applicant determined that the stainless steel seal cooler tubes can be exposed to temperatures greater than 140 °F, based on operating data, and that cracking is an applicable aging effect for the recirculation pump seal cooler. In addition, the applicant also discovered that the seal coolers were inadvertently omitted from LRA Tables 2.3.1-1, 3.1.2-1, and 3.3.1. The applicant revised the applicable tables as part of its response and performed an extent of condition review to ensure similar omissions did not occur. The staff finds the response acceptable because, although design differences would not allow chloride concentration to occur similar to that in the licensee event report, the applicant will manage cracking of the stainless steel seal cooler tubes because these components can be exposed to temperatures greater than 140 °F. In addition, the staff considers the applicant's extent of condition review for identifying comparable omissions in the LRA to be a reasonable corrective action. The staff's concerns described in RAI B.2.1.13-4 are resolved.

Based on its Audit Report, review of the application, and review of the applicant's responses to RAIs B.2.1.13-3 and B.2.1.13-4, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M21A was evaluated.

UFSAR Supplement. LRA Section A.2.1.13, as modified by letter dated August 6, 2015, provides the UFSAR supplement for the Closed Treated Water Systems program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that in Commitment No. 13 the applicant will implement the two program enhancements discussed above before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Closed Treated Water Systems program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent with AMP XI.M21A. The staff also reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Technical Information in the Application. LRA Section B.2.1.14 describes the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program as consistent, with an enhancement, with GALL Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." The LRA states that the AMP manages the aging effects of loss of material for bridge, bridge rails, and bolting and trolley structural components for cranes, hoists, and rigging beams exposed to an air-indoor uncontrolled and treated water environments. The AMP also manages the aging effect of loss of preload for bolted connections. The LRA states that the AMP manages these aging effects through periodic inspections consistent with the ASME Code B.30 series of standards. The AMP also has procedures and controls that implement the guidance in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic Technical Activity A-36," dated July 1980.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M23. 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 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 1. LRA Section B.2.1.14 includes an enhancement to the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements. In this enhancement, the applicant stated that additional guidance will be provided "to include inspection of structural components, rails, and bolting for loss of material due to corrosion; rails for loss of material due to wear; and bolted connections for loss of preload." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M23 and finds it acceptable because this will make the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program consistent with the GALL Report AMP XI.M23 recommendations to manage the effects of loss of material due to corrosion or wear for crane rails and structural components and loss of preload for bolted connections.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M23. In addition, the staff reviewed the enhancements associated with the "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.14 summarizes operating experience related to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The LRA states that, in June 2011, during a periodic inspection of the reactor building crane, the applicant detected signs of wear on the east and west side rails and associated bridge wheels of the crane. The applicant initiated a corrective action program issue report and took corrective actions to address this issue. Corrective actions taken by the applicant included working with the crane vendor to identify the cause of the damage, identifying that the cause of the damage was misalignment of the rails, making repairs to realign the rails, and replacing or repairing the wheels.

The LRA states that, in 2012, during inspection of the LSCS, Unit 2, turbine building crane, the applicant detected one sheared bolt and several loose structural bolts. The applicant initiated a corrective action program issue report to address this issue and removed the crane from service until repaired. As part of its corrective actions, the applicant determined that the bolts became loose due to the vibration in the trolley rails, which was caused by the increased friction at one of the cab wheels. The applicant inspected and repaired the cab wheels, tightened the loose bolts, and replaced the sheared bolt. To prevent recurrence of this issue the applicant revised its preventive maintenance tasks for the turbine and reactor building cranes to (1) include a requirement that a representative from the crane manufacturing company be present when performing annual periodic inspections and (2) use a man-lift during inspection of the cranes for a more thorough inspection.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M23 was evaluated.

UFSAR Supplement. LRA Section A.2.1.14 provides the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancement to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems 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 enhancement and confirmed that its implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Compressed Air Monitoring

Summary of Technical Information in the Application. LRA Section B.2.1.15 describes the existing Compressed Air Monitoring program as consistent, with an exception and enhancements, with GALL Report AMP XI.M24, "Compressed Air Monitoring." The LRA states that the AMP addresses loss of material on piping and components in a condensation environment in the compressed air systems. The LRA also states that the AMP proposes to manage the aging effect through monitoring of air moisture content and contaminants to maintain specified limits and through inspection of components for indications of loss of material due to corrosion. Additionally, the LRA states that the AMP is based on the response to NRC GL 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment," dated August 8, 1988.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M24. The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the exception 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 exception and enhancements follows.

Exception 1. LRA Section B.2.1.15 includes an exception to the "monitoring and trending" program element. In this exception, the applicant stated that dew point testing and trending is performed quarterly rather than daily as recommended in the GALL Report. The staff noted that the applicant uses the guidance of Section 5.1, "Pressure Dew Point," of American National Standard Institute (ANSI)/ISA-7.0.01-1996, "Quality Standard for Instrument Air," approved November 12, 1996, which states that "a monitored alarm is preferred; however, if a monitored alarm is unavailable, per shift monitoring is recommended." The staff also noted that the applicant's instrument compressed air system dryer outlet dew points are continuously monitored by in-line detectors with automatic alarms in the main control room. On a quarterly basis, samples are taken from representative locations and are analyzed for dew point, particulates, and hydrocarbons, which validates the dew point in-line detectors. The staff reviewed this exception against the corresponding program elements in GALL Report AMP XI.M24 and finds it acceptable because the applicant will continuously monitor the dew point, which will alert the applicant to any potential moisture within the system by an alarm in the control room. Additionally, taking quarterly air samples for dew point and contaminants is consistent with the guidance in ASME OM-S/G-1998, Part 17.

Enhancement 1. LRA Section B.2.1.15 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that inspection of internal surfaces of system filters, compressors, and after-coolers for signs of corrosion and corrosion products will be performed. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M24 and finds it acceptable because, when it is implemented, it will be consistent with the GALL Report recommendations.

Enhancement 2. LRA Section B.2.1.15 includes an enhancement to the "Monitoring and Trending" program element. In this enhancement, the applicant stated that analysis and trending will be performed on the results from the air quality monitoring and visual inspection. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M24 and finds it acceptable because, when it is implemented, it will be consistent with the GALL Report recommendations.

Enhancement 3. LRA Section B.2.1.15 includes an enhancement to the "Acceptance Criteria" program element. In this enhancement, the applicant stated that deficiencies will be documented in the corrective action program, which are identified during visual inspections of the internal surfaces of system components. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M24 and finds it acceptable because, when it is implemented, it will be consistent with the GALL Report recommendations.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M24. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.15 summarizes operating experience related to the Compressed Air Monitoring program. The applicant described a recent quarterly sample that was taken from several locations in the instrument air and drywell pneumatic air systems and analyzed for dew point, hydrocarbons, and particulates. The results were within the acceptance criteria for each parameter. The applicant also described receiving an alarm for the station air dryer high humidity in February 2008. The condition was documented in the corrective action program, and the applicant determined that a circuit board in the humidity sensing circuit needed to be replaced. After the applicant replaced the circuit board, it calibrated the humidity sensor and returned the dryer to service.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M24 was evaluated.

UFSAR Supplement. LRA Section A.2.1.15 provides the UFSAR supplement for the Compressed Air Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR

Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Compressed Air Monitoring program for managing the effects of aging for applicable components during the period of extended operation and committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Compressed Air Monitoring program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report XI.M24 are consistent. In addition, the staff reviewed the exception and its justifications and determines that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Fire Protection

Summary of Technical Information in the Application. LRA Section B.2.1.16 describes the existing Fire Protection program as consistent, with enhancements, with GALL Report AMP XI.M26, "Fire Protection." The LRA states that this program is a condition and performance monitoring program that manages the aging effects of the fire barriers and the low-pressure carbon dioxide (CO_2) systems and associated components exposed to air-indoor uncontrolled and air-outdoor environments through the use of periodic inspections and functional testing. This program includes visual inspections of no less than 10 percent of each type of penetration seal at least once per refueling cycle (24 months). This program also includes visual examinations of the fire barrier walls, ceilings, and floors at least once per 24 months. In addition, the program encompasses periodic visual inspections and functional testing of the fire doors and the low-pressure CO_2 fire suppression system components 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M26. The staff also reviewed the portions of the "parameters monitored or inspected," "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.2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that it will perform periodic visual inspection of combustible liquid spill retaining curbs. GALL Report AMP XI.M26 recommends that components with a fire barrier function be managed for aging. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will apply periodic visual inspections to the combustible liquid spill retaining curbs consistent with the GALL Report.

Enhancement 2. LRA Section B.2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that it will perform periodic visual inspection for identification of corrosion that may lead to loss of material on the external surfaces of the low-pressure CO_2 fire suppression systems. GALL Report AMP XI.M26 recommends that the CO_2 fire suppression system be visually inspected for signs of corrosion. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will apply visual inspections to the external surfaces of the low-pressure CO_2 systems visible to eyes consistent with the GALL Report. The staff noted that the applicant's inspection technique is also consistent with the industry practice of avoiding disrupting factory-installed insulation when conducting visual inspections of the CO_2 systems.

Enhancement 3. LRA Section B.2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that it will provide additional inspection guidance to identify additional aging effects of (a) fire barrier walls, ceilings, and floor degradation, such as spalling, cracking, and loss of material for concrete, and (b) elastomeric fire barrier material degradation, such as loss of material, shrinkage, separation from walls and components, increased hardness, and loss of strength. GALL Report AMP XI.M26 recommends visual inspections of the fire barrier walls, ceilings, floors, and other fire barriers to detect any sign of degradation, such as spalling, cracking and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will align its fire barrier inspections with the GALL Report guidance by explicitly specifying the examination of aging effects (e.g., spalling and cracking) during inspections.

Enhancement 4. LRA Section B.2.1.16 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that it will provide additional inspection guidance to identify degradation of fire barrier penetration seals for aging effects, such as loss of material, cracking, increased hardness, shrinkage, and loss of strength. GALL Report AMP XI.M26 recommends that visual inspections of penetration seals be performed to detect "any sign of degradation, such as cracking, seal separation from walls and components…that are directly caused by increased hardness, and shrinkage of seal material due to loss of material." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M26 and finds it acceptable because, when it is implemented, it will align the fire barrier inspections with the GALL Report guidance by explicitly specifying that examination of aging effects (e.g., shrinkage and increased hardness) during inspections.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M26. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.16 summarizes operating experience related to the Fire Protection program. In January 2009, the applicant identified a damaged electrical fire seal in the auxiliary building while performing periodic inspection of fire penetration seals. A 1-inch-diameter by 5-inch-deep hole through the outer gypsum layer was discovered. This defect was entered into the corrective action program, scheduled for repair, and evaluated by Engineering for meeting the design requirements in the damaged state.

In January 2009, the applicant identified a damaged fire seal on the turbine building side of the electrical wall penetration seal separating the auxiliary building and the LSCS, Unit 2, turbine building. The damaged gypsum seal was approximately 7 inches (width) by 2 inches (height) by 1 inch (depth). The condition was entered into the corrective action program. An evaluation was initiated to determine whether there was sufficient material left to maintain the fire barrier function.

In September 2005, a fire door was found inoperable because the door seam was damaged. Upon discovery, a compensatory measure of "once an hour fire watch" was instituted until the door was repaired and returned to service.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M26 was evaluated.

UFSAR Supplement. LRA Section A.2.1.16 provides the UFSAR supplement for the Fire Protection program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Fire Protection program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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 enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Fire Water System

Summary of Technical Information in the Application. LRA Section B.2.1.17 describes the existing Fire Water System program as consistent, with exceptions and enhancements, with

GALL Report AMP XI.M27, “Fire Water System,” as modified by LR-ISG-2012-02 “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation.” The LRA states that the AMP addresses sprinklers; nozzles; fittings; valve bodies; fire pump casings; hydrants; hose stations; standpipes; aboveground and buried piping; and components for water-based fire protection systems exposed to indoor uncontrolled air, outdoor air, condensation, and raw water to manage the effects of loss of material. The LRA also states that the AMP proposes to manage this aging effect through monitoring; performance monitoring; and preventive actions, such as periodic flushing and system performance testing.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant’s program to the corresponding program elements of GALL Report AMP XI.M27. For the “detection of aging effects” and “acceptance criteria” program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The “detection of aging effects” program element in GALL Report AMP XI.M27, as amended by LR-ISG-2012-02, recommends the use of National Fire Protection Association (NFPA) 25, “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,” Section 13.2.5, for main drain testing, which includes criteria for trending and comparison of full flow pressures and for actions to take, such as identification and correction, when there is a 10-percent reduction in full flow pressure. However, during its audit, the staff found that the applicant’s Fire Water System program states that, if there is a difference of 5 psi when comparing full flow pressures from the previous test, an issue report will be generated. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-5, requesting that the applicant justify how performing analysis and trending on changes in pressure will provide reasonable assurance that the main drain test will be consistent with NFPA 25 and GALL Report AMP XI.M27.

In its response dated July 1, 2015, the applicant stated that Enhancement 9 was added to the LRA. The enhancement is discussed below.

The “acceptance criteria” program element in GALL Report AMP XI.M27, as amended by LR-ISG-2012-02, recommends removing foreign organic or inorganic material from piping or sprinklers, determining its source, and correcting it. However, during the audit the staff found that the applicant’s Fire Water System program states that it will use the corrective action program to report any flow blockage found and that it will not remove the material, determine its source, and correct it. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-3, requesting that the applicant justify how the current “acceptance criteria” program element is sufficient.

In its response dated July 1, 2015, the applicant stated that Enhancement 3 was modified to include the specific actions identified in GALL Report AMP XI.M27, program element 6. The staff’s evaluation is documented in the Enhancement 3 section of this AMP.

The staff also reviewed the portions of the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements 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.

Original Exception 1. LRA Section B.2.1.17 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it does not perform annual main drain tests; instead, it performs alternative testing to meet the drain testing described in NFPA 25, Section 13.2.5. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-1, requesting that the applicant justify how the use of the proposed alternative testing methods to main drain tests will provide reasonable assurance that flow blockage will not occur.

In its response dated July 1, 2015, the applicant stated that it will perform main drain tests on all in-scope wet pipe sprinkler systems, dry pipe preaction sprinkler systems, and automatic deluge systems on an annual frequency, with the exception of two areas that will be on an RFO frequency, which is consistent with the recommendations in LR-ISG-2012-02.

The staff finds the applicant's response acceptable because GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, states that testing is to be performed in accordance with GALL Report AMP XI.M27 Table 4a, "Fire Water System Inspection and Testing Recommendations," which includes main drain tests on the aforementioned systems. Because consistency with the GALL Report is being met for this aspect of the "detection of aging effects" program element, the applicant withdrew the original Exception 1. The staff's concern described in RAI B.2.1.17-1 is resolved.

Exception 1. LRA Section B.2.1.17 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that deluge systems for charcoal units cannot be tested with water and that they have no provisions to perform an air test to verify that the spray openings are not obstructed. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-2, requesting that the applicant justify the use of visual examinations every 5 years in lieu of full flow or air tests for the charcoal filter deluge testing annually.

In its response dated July 1, 2015, the applicant stated that air testing of the charcoal filter deluge system will be performed on 8 of the 11 units in addition to valve cycling. The exception still remains because 3 of the 11 units have not been configured to allow for air testing or valve cycling. As such, these three units will have internal visual examinations performed if blockage is found in any of the aforementioned eight units.

Enhancement 6 was added to the LRA for the air testing of the 8 of the 11 systems on an annual frequency. Enhancement 7 was added to the LRA to perform inspections on the charcoal filter deluge nozzles and piping within the filter housing on a 24-month frequency.

The staff finds the applicant's response acceptable because a representative sample of the charcoal filter deluge systems on either an annual or 24-month frequency will be performed, and it is consistent with GALL Report AMP XI.M27 Table 4a, "Fire Water System Inspection and Testing Recommendations," which recommends using NFPA 25. The staff's concern described in RAI B.2.1.17-2 is resolved.

Exception 2. LRA Section B.2.1.17 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that, because variations in wall thickness are possible due to manufacturing tolerances, followup volumetric examinations will not be performed when the observed wall thickness is indicative of wall thickness below nominal, even when surface irregularities are detected. The applicant stated that it will perform periodic visual internal inspections for loss of material and flow blockage in conjunction with volumetric examinations when appropriate to evaluate unexpected levels of degradation. The staff reviewed this exception against the corresponding program element in GALL Report

AMP XI.M27 and finds it acceptable because the staff recognizes that piping may have wall thickness less than nominal due to manufacturing process variations.

Exception 3. LRA Section B.2.1.17 includes an exception to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this exception, the applicant stated that external visual inspections of sprinkler systems are performed on a 24-month frequency, in accordance with the Technical Requirements Manual (TRM) Section 3.7.k, rather than on the annual basis stated in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-4, requesting that the applicant justify the frequency of inspections for the sprinklers and the exclusion of visual examination criteria for leakage, loss of fluid in the glass bulbs, and loading from sprinkler inspections.

In its response dated July 1, 2015, the applicant stated that the NRC-approved TRM and Fire Protection Program establishes a 24-month inspection plan. In addition, inspection results did not identify any age-related degradation issues.

The applicant also stated that Enhancement 8 was added to identify the need to inspect for water leakage and loss of fluid in the glass bulbs. Loading was not added to the program because it is already contained in the site inspection procedure LOS-FP-SR3.

The staff finds the applicant's response acceptable because the 24-month frequency was preapproved by the NRC and is in accordance with an RFO cycle frequency. Additionally, with the addition of Enhancement 8 to the LRA, the applicant is consistent with GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, to provide reasonable assurance that sprinkler systems will be able to perform their intended function during the period of extended operation. The staff's concern described in RAI B.2.1.17-4 is resolved.

Enhancement 1. LRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that volumetric examinations will be performed every year at five locations on carbon steel aboveground fire water piping that is susceptible to microbiologically-induced corrosion to identify loss of material. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will inspect and detect degradation on a representative sampling basis at a specified frequency, in accordance with GALL Report AMP XI.M27, as modified by LR-ISG-2012-02.

Enhancement 2. LRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that visual inspections will be performed for loss of material and flow obstructions of the accessible header piping and sparger external surfaces for the deluge systems located within filter plenums on a once per refueling cycle frequency. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will be consistent with GALL Report AMP XI.M27 in that inspections will be performed to detect degradation on a refueling cycle frequency.

Enhancement 3. LRA Section B.2.1.17 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that internal visual inspections of sprinkler and deluge system piping will be performed to identify internal corrosion and obstructions to flow. However, if a flow obstruction is observed, the applicant will note the obstruction in the corrective action program. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-3, requesting that the applicant provide justification for the "acceptance criteria" program element on removing foreign organic or inorganic material found obstructing piping or sprinklers and on determining and correcting its source versus simply adding the noted material in the corrective action program.

In its response dated July 1, 2015, the applicant stated that it added the guidance to remove, to determine the source, and to correct foreign material found obstructing piping or sprinklers to this enhancement to be consistent with the guidance in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02.

The staff finds the applicant's response acceptable because, with the addition of removing the material, determining its source, and correcting foreign material found obstructing piping or sprinklers, it provides reasonable assurance that the fire water sprinkler and deluge system piping will be able to perform its intended function throughout the period of extended operation. The staff's concern described in RAI B.2.1.17-3 is resolved.

Enhancement 4. LRA Section B.2.1.17 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that it will perform obstruction evaluations of the fire water system when degraded conditions are identified by visual inspections, flow testing, or volumetric examinations. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will perform various types of testing to detect and measure degradation in the fire water system for possible sources of materials that could cause pipe blockage.

Enhancement 5. LRA Section B.2.1.17 includes an enhancement to the "detection of aging effects" and "monitoring and trending" program elements. In this enhancement, the applicant stated that it will demonstrate the capability to provide the design pressure at required flow by performing flow tests for hose stations at the hydraulically most limiting locations for each zone of the system on a 5-year frequency. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will provide reasonable assurance that the intended function, which is to ensure the required flow at the required pressure, will be maintained throughout the period of extended operation.

Enhancement 6. By letter dated July 1, 2015, the applicant revised LRA Sections A.2.1.17 and B.2.1.17 to include an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that for charcoal filter units it will perform annual air tests on the deluge systems, excluding three filter unit systems. In addition, visual internal examinations will be performed on the three excluded tests if blockage is found on any deluge system that could be generic in nature. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable as documented in Exception 1.

Enhancement 7. By letter dated July 1, 2015, the applicant revised LRA Sections A.2.1.17 and B.2.1.17 to include an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that it will perform visual inspections on a 24-month frequency of all charcoal filter unit deluge nozzles for verification that the nozzles are not obstructed and have proper orientation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable as documented in Exception 1.

Enhancement 8. By Letter dated July 1, 2015, the applicant revised LRA Sections A.2.1.17 and B.2.1.17 to include an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. In this enhancement, the applicant stated that when performing visual inspections of sprinkler systems, it will include an inspection for water leakage and loss of fluid in the glass bulbs of sprinkler heads. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will provide reasonable assurance that any sprinklers exhibiting signs of leakage and loss of fluid in the glass bulbs, along with the other inspection criteria already included, will be replaced, consistent with NFPA 25, in accordance with GALL Report AMP XI.M27, as amended by LR-ISG-2012-02.

Enhancement 9. By letter dated July 1, 2015, the applicant revised LRA Sections A.2.1.17 and B.2.1.17 to include an enhancement to the “monitoring and trending” and “acceptance criteria” program elements. In this enhancement, the applicant stated that for main drain testing, acceptance criteria will include the monitoring of flowing pressures from test to test. The applicant also stated that an issue report will be generated to determine the cause and to correct it, if necessary, if there is a 10-percent reduction in full flow pressure when compared to that of previously performed tests. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because any degradation noted will be addressed with an issue report when a 10-percent reduction in full flow pressure compared to that of previously performed tests is identified. This provides reasonable assurance throughout the period of extended operation that a degrading trend will be identified and corrected to ensure that the intended function of the fire water system will be maintained. The staff’s concern described in RAI B.2.1.17-5 is resolved by the addition of this enhancement.

Enhancement 10. By letter dated July, 1, 2015, the applicant revised LRA Sections A.2.1.17 and B.2.1.17 to include an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements. In this enhancement, the applicant stated that a 2-year frequency for yard loop flow testing will be maintained until the section of piping from the pump house to node 515 is restored to normal flow conditions. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27 and finds it acceptable because, when implemented, it will use the corrective action program and past test data to ensure that the affected section of piping will perform its intended function throughout the period of extended operation.

Based on its audit and review of the applicant’s responses to RAIs B.2.1.17-1, B.2.1.17-2, B.2.1.17-3, B.2.1.17-4, and B.2.1.17-5, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M27. The staff also reviewed the exceptions associated with the “detection of aging effects” program element and their justifications and finds that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements associated with the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.17 summarizes operating experience related to the Fire Water System program. In January 2012 and March 2010, through-wall leaks were identified in fire header piping and fire protection piping for the diesel generator, respectively, and were entered into the corrective action program. These were also evaluated as a part of the raw water corrosion program, and each of the leaking piping segments was isolated and replaced. An extent of condition review was performed, which resulted in UT examinations at additional locations that identified material loss. After a review of the operating experience by the applicant, instances of material loss, including recurring internal corrosion in the fire water system piping, were noted. Because of this noted material loss, the applicant stated it will perform inspections on the carbon steel fire water piping for corrosion and degradation of the piping internal surfaces to incorporate guidance from LR-ISG-2012-02.

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. 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 evaluated and incorporated operating experience related to this program.

During its review, the staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

During the audit of the applicant's operating experience database, the staff noted that there were many issue reports generated on the fire water protection system regarding degradation of flow characteristics (i.e., C factor) in the underground fire loop, which is a raw water system. During the audit, the applicant provided a marked up copy of plant drawing M-775, sheet 1, showing the fire protection yard loop with annotated flow testing node points. The applicant provided additional data to the staff on the C factor from years 2006 through 2014. Based on the staff's review, the piping segment from the diesel-driven fire pump to node 515 shows a significant degrading trend. By letter dated June 8, 2015, the staff issued RAI B.2.1.17-6, requesting that the applicant justify how the degraded section of the fire protection yard loop from the diesel-driven fire pump to node 515 will be able to perform its intended function with its current significant degrading trend.

In its response dated July 1, 2015, the applicant stated that the fire protection yard loop is required to be flow tested on a 36-month frequency, based on TRM Section 3.7.j.18. Even though the corrective action program must be used to note system degradation and to reduce the testing frequency to annually if the C factor is between 70 and 75, Enhancement 10 was added to the LRA to maintain a testing frequency of 24 months until the section of piping from the diesel-driven fire pump to node 515 is restored to normal flow conditions with a post-maintenance test, at which time the frequency would be returned to 36 months.

The staff finds the applicant's response acceptable because the applicant is using the corrective action program and past test data to ensure that the affected section of piping will perform its intended function throughout the period of extended operation. The staff's concern described in RAI B.2.1.17-6 is resolved.

Based on its audit and review of the application and review of the applicant's response to RAI B.2.1.17-6, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M27 was evaluated.

UFSAR Supplement. As amended by letter dated July 1, 2015, LRA Section A.2.1.17 provides the UFSAR supplement for the Fire Water System program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated July 1, 2015, is an adequate summary description of the program.

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 with GALL Report AMP XI.M27. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Aboveground Metallic Tanks

Summary of Technical Information in the Application. LRA Section B.2.1.18, as amended by letter dated August 6, 2015, describes the existing Aboveground Metallic Tanks program as consistent, with enhancements, with GALL Report XI.M29, "Aboveground Metallic Tanks," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." The LRA states that the AMP is a condition monitoring program that addresses outdoor tanks sited on soil or concrete and certain indoor large volume tanks exposed to outdoor air, concrete, condensation, soil, and treated water environments to manage the effects of loss of material and loss of sealing. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections and volumetric examinations. The LRA further states that the only tanks within the scope of the AMP are the cycled condensate storage tanks, which are fabricated from aluminum alloys that are not susceptible to SCC.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M29. The staff also reviewed the portions of the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with a staff-identified difference 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 this staff-identified difference and enhancements follows.

Staff-Identified Difference. LRA Section B.2.1.18 does not manage the aging effect of cracking and does not take an exception to GALL Report AMP XI.M29. This staff-identified difference affects the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. During the audit, the staff reviewed drawings and construction details associated with the two cycled condensate storage tanks. The drawings specify that the tanks are constructed from 5454-O plate, 6061-T6 structural members, 6061-T6 piping, and 6061-O extruded shapes. The staff also noted that LRA Table 3.4.2-1, "Condensate System," plant-specific note 3, states that the tanks are constructed from aluminum alloys that are not susceptible to SCC. AMR item 3.4.1-31, cites plant-specific note 3.

Aluminum alloy 5454 has a maximum magnesium content of 1.0 weight percent per ASTM B209-14, "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate," dated November 2014. The 5xxx series aluminum alloys are not susceptible to SCC unless the magnesium content is 3.5 weight percent or greater (1, 2). Therefore, aluminum alloy 5454-O is not susceptible to SCC. The 6xxx series aluminum alloys are highly resistant to SCC in all standard compositions, tempers, and product forms. Aluminum alloy 6061 is only susceptible to SCC after being exposed to nontypical heat treatments, which would be outside of standard material processes and specifications (1, 2). Aluminum alloy 6061 in the T6 and O temper is not a nontypical condition. Therefore, aluminum alloys 6061-T6 and 6061-O are not susceptible to SCC. The staff referenced the following two documents to confirm that the alloys are not susceptible to SCC:

(1) B.F. Brown, "Stress-Corrosion Cracking in High Strength Steels and in Titanium and Aluminum Alloys," Naval Research Laboratory, 1972

(2) J.R. Davis, "Corrosion of Aluminum and Aluminum Alloys," ASM International, 1999

The staff reviewed the difference between the LRA AMP and the GALL Report AMP, which should have been identified as an exception, and finds it acceptable because it has been verified that the materials of construction are aluminum alloy-temper combinations that are not susceptible to cracking due to SCC. Therefore, the aspects of the program elements associated with the staff-identified difference are not applicable to the in-scope tanks.

Enhancement 1. LRA Section B.2.1.18 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that visual inspections will be performed on all wetted and nonwetted interior surfaces on one of the two cycled condensate storage tanks for loss of material within 5 years before the period of extended operation. The LRA also states that if volumetric inspections are performed from the outside of the tank, instead of internal visual inspections, 25 percent of the tank surface area will be inspected. The LRA further states that if degradation is identified, periodic inspections will be conducted on both tanks at a frequency established based on the rate of degradation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M29 and finds it acceptable because, when it is implemented, it will ensure that the extent of inspections, frequency of inspections, and parameters monitored will be consistent with GALL Report guidance.

Enhancement 2. LRA Section B.2.1.18 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that visual inspections will be performed on the external surfaces of both cycled condensate storage tanks for loss of material each refueling interval. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M29 and finds it acceptable because, when it is implemented, it will ensure that the extent of inspections, frequency of inspections, and parameters monitored will be consistent with GALL Report guidance.

Enhancement 3. LRA Section B.2.1.18, as amended by letter dated August 6, 2015, includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. In this enhancement, the applicant stated that the tank bottoms of both cycled condensate storage tanks will be volumetrically examined for loss of material whenever they are drained. The LRA also states that the volumetric examinations of the tank bottoms will begin 10 years before the period of extended operation and each 10-year period after. The next inspection will cover approximately 20 percent of each tank bottom. The LRA states that the 20 percent will comprise the area extending 30 inches in from the shell and 10 locations outside of the 30-inch band of approximately 1 ft^2 in size. The results of this inspection will be used to determine the scope and locations of the subsequent inspection in accordance with the corrective action program. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M29 and finds it acceptable because, when it is implemented, it will ensure that age-related degradation of the tank bottoms is detected before the loss of intended function, as discussed in RAI B.2.1.18-1.

Enhancement 4. LRA Section B.2.1.18, as amended by letter dated August 6, 2015, includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that an inspection of the caulking at the perimeter of both cycled condensate storage tanks will be performed each refueling cycle. The visual inspection of the caulking is supplemented with physical manipulation. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M29 and finds it acceptable because, when it is implemented, it will ensure that the caulking is inspected using methods and frequency consistent with GALL Report guidance.

Based on its audit and review of the applicant's responses to RAIs B.2.1.18-1 and B.2.1.18-2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M29. The staff also reviewed a difference between the LRA AMP and the GALL Report AMP associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and dispositioned the staff-identified difference as acceptable. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements and finds that, when implemented, they will ensure that the AMP is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.18 summarizes operating experience related to the Aboveground Metallic Tanks program. Degradation of the caulking at the perimeter of the base of the LSCS, Unit 2, cycled condensate storage tank was identified during a routine walkdown in October 2012. The LRA states that the operator that observed the degradation entered it into the corrective action program and that maintenance personnel repaired that caulk. The LRA also states that the LSCS, Unit 1, cycled condensate storage tank experienced leakage in 2010 and that subsequent inspections revealed that loss of material had resulted in areas of thinning on both tank bottoms. Patches have been installed on the bottoms of both cycled condensate storage tanks to repair areas that were found to be below nominal thickness.

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. 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 evaluated and incorporated operating experience related to this program. The staff identified operating experience for which it determined the need for additional clarification that resulted in the issuance of an RAI, as discussed below.

The Aboveground Metallic Tanks program has an enhancement (Enhancement 3) to perform volumetric inspections in accordance with LR-ISG-2012-02, Table 4a. During the onsite audit of the applicant's Aboveground Metallic Tanks program, the staff further reviewed operating experience associated with the aging of tank bottoms that the applicant cited in the LRA. The sufficiency of Enhancement 3 to effectively manage the tank bottoms for loss of material could not be determined during the audit. It was unclear to the staff if the extent and locations of the volumetric inspections being performed are sufficient to manage loss of material during the period of extended operation. By letter dated July 7, 2015, the staff issued RAI B.2.1.18-1, requesting that the applicant provide the extent of the volumetric inspections being performed and the methodology used to select the inspection location of the tank bottoms.

In its response dated August 6, 2015, the applicant stated that 100 percent of both tank bottoms have been inspected and that the inspection revealed that the tank bottom thinning is primarily located within 20 inches of the shell. The response also stated that the extent of the inspections being performed has been expanded to inspect 100 percent of the tank bottoms within 30 inches of the shell in addition to 10 random locations elsewhere on the tank bottoms. The inspections will include all locations previously found to be susceptible to thinning. The inspections will be performed using a volumetric technique to identify locations of potential flaws, which will be re-inspected using a discrete UT technique. The response stated that the results of the inspection will be entered into the corrective actions program to determine the scope of subsequent inspections.

The staff finds the applicant's response acceptable because the extent of the volumetric inspections being performed on the tank bottoms has been expanded and focuses on the locations that site-specific operating experience has shown to be most susceptible to loss of material. The expanded scope of the inspections will ensure that age-related degradation of the tank bottoms is detected before the loss of intended function. The applicant has also revised LRA Section A.2.1.18, Section B.2.1.18, Enhancement 3, and Commitment No. 18 to reflect the expanded inspections.

Based on its audit, review of the application, and review of the applicant's response to RAI B.2.1.18-1, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M29 was evaluated.

UFSAR Supplement. LRA Section A.2.1.18, as amended by letter dated August 6, 2015, provides the UFSAR supplement for the Aboveground Metallic Tanks program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02, and noted that the visual examination of caulking is not supplemented with physical manipulation. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information in its UFSAR supplement. By letter dated July 7, 2015, the staff issued RAI B.2.1.18-2, requesting that the applicant provide the technical basis used to determine that visual inspection of the caulking at the interface of the tank bottom and foundation, without supplemental physical manipulation, is adequate to assess the degradation of the caulking during the period of extended operation.

In its response dated August 6, 2015, the applicant stated that its AMP has been revised to include the physical manipulation of caulking. The applicant has also revised LRA Section A.2.1.18, Section B.2.1.18, Enhancement 4, and Commitment No. 18 to reflect the inclusion of the physical manipulation of caulking.

The staff finds the applicant's response acceptable because it is consistent with GALL Report AMP XI.M29 and SRP-LR Table 3.0-1, as modified by LR-ISG-2012-02. The staff's concern described in B.2.1.18-2 is resolved. The staff also noted that the applicant committed (Commitment No. 18) to the implementation of the enhancements. The staff finds that the information in the UFSAR supplement, as amended by letter dated August 6, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Aboveground Metallic Tanks program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff evaluated a staff-identified difference and determined that the AMP, with the staff-identified difference, is adequate to manage the applicable aging effects. The staff also reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Fuel Oil Chemistry

Summary of Technical Information in the Application. LRA Section B.2.1.19 describes the existing Fuel Oil Chemistry program as consistent, with enhancements, with GALL Report AMP XI.M30, "Fuel Oil Chemistry." The LRA states that the Fuel Oil Chemistry program manages loss of material in piping, tanks, and other components exposed to an environment of fuel oil by periodically testing the quality of the fuel oil. The program monitors water, sediments, total particulate, and levels of microbiological activity. Additionally, the program periodically samples, drains, cleans, and internally inspects tanks for signs of moisture, contaminants, and corrosion. A one-time inspection activity will be performed to verify the effectiveness of the Fuel Oil Chemistry program.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M30. The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" 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.2.1.19 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that the diesel fuel storage tanks will undergo a periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 2. LRA Section B.2.1.19 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that the high pressure core spray (HPCS) diesel fuel storage tanks will undergo a periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 3. LRA Section B.2.1.19 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that the diesel generator day tanks will undergo a periodic (quarterly) sampling and analysis for water and sediment content and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 4. LRA Section B.2.1.19 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that the HPCS diesel day tanks will undergo a periodic (quarterly) sampling and analysis for water and sediment content and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 5. LRA Section B.2.1.19 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that the diesel fire pump day tanks will undergo a periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 6. LRA Section B.2.1.19 includes an enhancement to the "preventive actions" and "detection of aging effects" program elements. In this enhancement, the applicant stated that, for the diesel fire pump day tanks, it will perform periodic internal inspections at least once during the 10-year period before the period of extended operation and at least once every 10 years during the period of extended operation. The tanks will be drained and cleaned; the internal surfaces visually inspected (if physically possible); and, if evidence of degradation is observed during inspections or if visual inspection is not possible, these diesel fuel tanks will be volumetrically inspected. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 7. LRA Section B.2.1.19 includes an enhancement to the "detection of aging effects" program element. The diesel fuel storage tanks, HPCS diesel fuel storage tanks, diesel generator day tanks, and HPCS diesel day tanks are currently visually inspected at a 10-year frequency. In this enhancement, the applicant stated that the diesel fuel storage tanks, diesel generator day tanks, HPCS diesel fuel storage tanks, and HPCS diesel day tanks will be subjected to a volumetric examination if evidence of degradation is observed during visual inspection or if visual inspection is not possible. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Enhancement 8. LRA Section B.2.1.19 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that, for all diesel tanks within the scope of license renewal, it will perform periodic (quarterly) trending of water and sediment content, particulate concentration, and levels of microbiological organisms. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M30 and finds it acceptable because, when it is implemented, it will make the applicant's AMP program consistent with the GALL Report.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M30. In addition, the staff reviewed the enhancements associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.19 summarizes operating experience related to the Fuel Oil Chemistry program. In July 2013 the applicant identified a monthly surveillance procedure that lacked direction on reporting and trending. The system manager is responsible for reviewing the results of chemistry analyses. However, the procedure does not provide guidance to notify the system manager when water is discovered. The monthly surveillance procedure was revised to require the initiation of a corrective action program issue report and system manager notification upon the discovery of water during the monthly surveillance.

In September 2009, the results of the analysis for new fuel oil for the diesel fuel storage tank indicated that the fuel oil passed the water and sediment test but failed the clear and bright appearance test. A corrective action program issue report was initiated. Engineering evaluated the acceptability of adding the new fuel oil to the storage tank. The water and sediment test was determined to be the more rigorous test and would capture the percent volume of water that might be seen under the clear and bright appearance test. Based on this, it was concluded that the new fuel oil was acceptable for use.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M30 was evaluated.

UFSAR Supplement. LRA Section A.2.1.19 provides the UFSAR supplement for the Fuel Oil Chemistry program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Fuel Oil Chemistry program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

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 GALL Report AMP XI.M30. In addition, the staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Monitoring of Neutron-Absorbing Materials Other Than Boraflex

Summary of Technical Information in the Application. LRA Section B.2.1.27 describes the existing Monitoring of Neutron-Absorbing Materials Other Than Boraflex program as consistent, with an enhancement, with GALL Report AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other Than Boraflex." The program is a condition monitoring program that includes periodic inspection and analysis of test coupons of the neutron-absorbing material in the spent fuel storage racks to determine whether the neutron-absorbing capability of the material has degraded in a treated water environment. The program ensures that the 5-percent subcriticality margin is maintained by monitoring loss of material, changes in dimension, and loss of neutron-absorbing capacity of the material. The LRA states that the neutron-absorbing material installed in the LSCS, Unit 1, spent fuel storage racks is Boral. The LSCS, Unit 2, spent fuel storage racks use Netco inserts, which consists of a Rio Tinto Alcan composite as the neutron-absorbing material.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M40. The staff also reviewed the portions of the "monitoring and trending" program element associated with an 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 1. LRA Section B.2.1.27 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that, before the period of extended operation, it will maintain the test coupon exposure so that it is bounding for the neutron-absorbing material in all spent fuel racks by relocating the coupon tree to a different spent fuel rack cell location each cycle and by surrounding the coupons with a greater number of freshly discharged fuel assemblies than that of any other cell location. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M40 and finds it acceptable because the proposed coupon exposure plan will maintain the coupons as leading indicators for potential degradation of the Boral and the Netco inserts in the fuel storage cells. The staff finds that, when this enhancement is implemented, it will make the AMP consistent with the recommendations of GALL Report AMP XI.M40.

Operating Experience. LRA Section B.2.1.27 summarizes operating experience related to the Monitoring of Neutron-Absorbing Materials Other Than Boraflex program. The applicant provided the following operating experience.

In 2004 and 2009, the applicant stated that Boral coupons were removed from the LSCS, Unit 1, spent fuel pool and analyzed. The results of the post-irradiated coupon surveillance were compared to the original pre-irradiated data for evidence of blistering, swelling (bulging), loss of material, and decrease in boron-10 areal density to determine whether there has been any loss of neutron-absorption capability, and the applicant confirmed that no significant deterioration or degradation had occurred.

In 2009 and 2013, the applicant stated that Netco insert coupons for the fast start program were removed from the LSCS, Unit 2, spent fuel pool and analyzed. The results of the post-irradiated coupon surveillance were compared to the original pre-irradiated data for evidence of blistering, swelling (bulging), loss of material, and decrease in boron-10 areal density to determine whether there has been any loss of neutron-absorbing capability, and the applicant confirmed that no significant deterioration or degradation had occurred.

During the staff's audit of this program, the applicant indicated that it completed installation of the Netco inserts in 2011, which replaced the previously credited Boraflex neutron-absorbing material. The applicant performed this action after identifying ongoing degradation of Boraflex. Boraflex is no longer credited for neutron absorption in the LSCS, Unit 2, spent fuel pool.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M40 was evaluated.

UFSAR Supplement. LRA Section A.2.1.27 provides the UFSAR supplement for the Monitoring of Neutron-Absorbing Materials Other Than Boraflex program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Monitoring of Neutron-Absorbing Materials Other Than Boraflex program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Monitoring of Neutron-Absorbing Materials Other Than Boraflex 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 enhancement and confirmed that its implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 Buried and Underground Piping

Summary of Technical Information in the Application. Subsequent to the issuance of the SER with open items, the staff issued LR-ISG-2015-01. By letter dated April 13, 2016, the applicant revised its Buried and Underground Piping program to address the changes in LR-ISG-2015-01. As modified, LRA Section B.2.1.28 describes the existing Buried and Underground Piping program as consistent, with enhancements, with GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," as modified by LR-ISG-2015-01. The LRA states that the AMP addresses carbon steel and stainless steel buried and underground piping and piping components exposed to soil and outdoor air to manage the effects of cracking and loss of material. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections; preventive and mitigative actions, including coatings, backfill quality, and cathodic protection; and periodic verification of the effectiveness of the cathodic protection system.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M41, as modified by LR-ISG-2011-03.

LRA Section B.2.1.28 states that soil corrosion probes may be used to verify the effectiveness of the cathodic protection system during annual surveys. The applicant stated that the probes will be placed in close proximity to the piping. The applicant also stated that other considerations for placement of the probes include (a) soil moisture content, pH, and resistivity, (b) location of anode beds, (c) proximity of the test points in relation to the pipe, nearby anode beds, and components with large buried surfaces that can affect cathodic protection readings and localized protection, and (d) the effect of cathodic shielding and large current collectors. Cathodic protection will be considered effective if less than 1 mil per year (mpy) is detected or if a remaining life calculation is performed, which demonstrates that the component intended function will be maintained through the period of extended operation. The remaining life option will only be used when volumetric thickness measurements were conducted on the pipe when the soil corrosion probe was installed. The applicant further stated that NACE International Publication 05107, "Report on Corrosion Probes in Soil or Concrete," will be used during installation, use, and application of the results. Input will be used from equipment vendors, manufacturers, and individuals with a NACE International CP4, "Cathodic Protection Specialist," qualification in regard to the installation and use of the probes.

The "acceptance criteria" program element of GALL Report AMP XI.M41, as modified by LR-ISG-2011-03, recommends either a -850 mV relative to a copper sulfate electrode instant off criterion or a 100-mV minimum polarization criterion to assess the effectiveness of a cathodic protection system. Although the applicant did not cite an exception for its use of a 1-mpy loss of material as an acceptance criterion to demonstrate effectiveness of the cathodic protection system, the staff's evaluation of the applicant's proposal follows. The staff noted the following:

- Based on a review of NACE International Publication 05107, soil corrosion probes are capable of measuring corrosion rates of the probe by correlating increases in electrical resistance to a loss of material of the probe. The rate of corrosion of the probe provides a direct indication of the effectiveness of the cathodic protection system in the vicinity of the probe.
- NACE International Publication 05107 provides guidance on the installation and use of soil corrosion probes, including material type, size of probe, soil contact, proximity to the piping that it is representing, circuit configurations, corrosion rate calculation formulas, and acceptance criteria. Use of the guidance of this publication in conjunction with vendor, manufacturer, and NACE International-qualified cathodic protection expert recommendations can result in effectively determining the corrosion rate of buried components.
- The 1-mpy acceptance criterion is consistent with NACE International Publication 05107. The twofold acceptance criterion (i.e., 1 mpy, remaining life calculation) can be sufficient to provide reasonable assurance that either local cathodic protection is effective or ineffective, as the case may be.
- NACE offers four levels of qualification consisting of cathodic protection tester, cathodic protection technician, cathodic protection technologist, and cathodic protection specialist (NACE Courses CP 1 through CP 4). The staff noted that the NACE website (accessed on March 19, 2015), http://www.naceinstitute.org/Certification/, states that the NACE CP 4 Cathodic Protection Specialist is, "geared toward those persons involved in the design, installation, and maintenance of cathodic protection systems."

The staff noted that the 1 mpy acceptance criterion is a standard industry value used to demonstrate an effective cathodic protection system. However, the staff did not find the applicant's proposal acceptable because, in part, the staff lacked sufficient information to conclude that there is reasonable assurance that all buried in-scope piping would be capable of meeting its CLB intended function with 60 mils of corrosion that could occur through the end of the period of extended operation. By letter dated May 29, 2015, the staff issued RAI B.2.1.28-1, requesting that the applicant state whether all buried in-scope components will be able to perform their licensing basis intended function(s) if a 60-mil loss of material were to occur through the end of the period of extended operation.

In its response dated June 25, 2015, the applicant stated that the buried in-scope piping is "capable of withstanding at least 60 mils of material loss from 87.5 percent of the nominal pipe wall thicknesses (manufacturers tolerance), while still maintaining their licensing basis intended function."

The staff finds the applicant's response acceptable because the applicant confirmed that the design tolerances for buried in-scope piping will accommodate the industry standard 1-mpy acceptance criterion related to the effectiveness of a cathodic protection system. The staff's concern described in RAI B.2.1.28-1 is resolved.

The staff finds the applicant's proposal to use soil corrosion probes to assess the effectiveness of localized adequacy of cathodic protection acceptable because (a) based on industry-wide use, soil corrosion probes are capable of providing localized corrosion rates that can be assessed against an acceptance criterion to demonstrate the effectiveness of a cathodic protection system, (b) soil corrosion data will be factored into the placement of soil corrosion probes, which will result in the probe data not being misleading due to potential soil impacts on corrosion rates, (c) the applicant identified appropriate factors to consider for site structure impacts (e.g., cathodic shielding and large current collectors), (d) an acceptance criterion of 1 mpy is an industry-accepted value, and the applicant stated that all of its in-scope buried pipe has sufficient margin to accommodate this criterion throughout the period of extended operation, (e) as-found wall thickness measurements will be obtained when soil corrosion probes are installed, and these measurements will be used to determine a remaining life, thus eliminating the need to project corrosion rates that have occurred since installation, (f) NACE International Publication 05107 provides appropriate guidance on the installation and use of soil corrosion probes, and (g) personnel providing input for the location of soil corrosion probes, and the use of soil corrosion probe data, will be appropriately qualified.

The staff also reviewed the portions of the “preventive actions,” “parameters monitored or inspected,” “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. By letter dated April 13, 2016, the applicant revised Enhancement Nos. 3, 4, 6, and 7. The staff’s evaluation of these enhancements and changes follows.

Enhancement 1. LRA Section B.2.1.28 includes an enhancement to the “parameters monitored or inspected” program element. In this enhancement, the applicant stated that inspections for cracking of stainless steel piping will use a method that has been demonstrated to be capable of detecting cracking. The applicant also stated that inspections for cracking will only occur when coatings have been removed so that the base material is exposed. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, monitoring for cracking in stainless steel components will be consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, in both the selection of inspection methods and when inspections for cracking will be conducted.

Enhancement 2. LRA Section B.2.1.28 includes an enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that it will “[e]nsure [that] all underground carbon steel Essential Cooling Water System and Nonessential Cooling Water System piping and components within the scope of license renewal are coated in accordance with Table 1 of NACE SP0169-2007.” The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, coating underground piping in accordance with Table 1 of NACE International SP0169-2007 is consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and the coating can ensure that loss of material will not occur. The staff noted that, by letter dated April 13, 2015, the applicant stated that, “[t]here is no cementitious piping within the scope of license renewal. All buried stainless steel piping and components within the scope of license renewal are coated.” The staff concluded that coating underground stainless steel piping is consistent with AMP XI.M41 as modified by LR-ISG-2015-01.

Enhancement 3. As amended by letter dated April 13, 2016, LRA Section B.2.1.28 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that it will “[d]efine acceptable coating conditions as coating exhibiting either no evidence of degradation, or, the type and extent of coating damage evaluated as insignificant by” an individual qualified by any one of the three methods recommended in AMP XI.M41 as modified by LR-ISG-2015-01.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, it will be consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and because using individuals with appropriate qualifications can result in effective inspections of the condition of coatings.

Enhancement 4. As amended by letter dated April 13, 2016, LRA Section B.2.1.28 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that (a) the number of inspections of in-scope buried piping will be conducted in accordance with Table XI.M41-2, "Inspections of Buried and Underground Piping and Tanks," of GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, (b) inspections will be conducted in each 10-year period commencing 10 years before the period of extended operation, and (c) "[t]he number of inspections of buried piping will be based upon the as-found results of cathodic protection system availability and effectiveness." The applicant also stated that the length of piping for each inspection will be based on the recommendations in LR-ISG-2015-01, Appendix B, item 4.c ("detection of aging effects" program element). The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, the number of inspections of in-scope buried piping and frequency will be consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01.

Enhancement 5. LRA Section B.2.1.28 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will "[p]erform direct visual inspections of underground Essential Cooling Water System and Nonessential Cooling Water System piping within the scope of license renewal during each 10-year period, beginning 10 years prior to the period of extended operation." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, the periodicity of conducting underground piping inspections will be consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01.

Enhancement 6. As amended by letter dated April 13, 2016, LRA Section B.2.1.28 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that:

> When measured pipe wall thickness, projected to the end of the period of extended operation, does not meet the minimum pipe wall thickness requirements, the number of inspections within the affected piping categories will be doubled or increased by five (5), whichever is smaller. If adverse indications are found in the expanded sample, an analysis will be conducted to determine the extent of condition and extent of cause. The size of the followup inspections will be determined based on the analysis. Timing of the additional inspections will be based on the severity of the identified degradation and the consequences of leakage. The additional inspections will be performed within the same 10-year inspection interval in which the original degradation was identified, or within 4-years after the end of the 10-year interval if the degradation was identified in the latter half of the 10-year interval. Expansion of sample size may be limited by

the extent of piping subject to the observed degradation mechanism or if the piping system or portion of the system is replaced.

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, the number of additional inspections when adverse indications are detected and the timing of these inspections will be consistent with GALL Report AMP XI.M41, as modified by LR-ISG-2015-01.

Enhancement 7. As amended by letter dated April 13, 2016, LRA Section B.2.1.28 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that it will use either the -850-mV instant off polarized potential criterion specified in NACE international SP0169-2007 or the corrosion rate demonstrated by soil corrosion probes to determine the effectiveness of the cathodic protection system. The applicant also stated that it will establish an upper limit of -1200 mV for pipe-to-soil potential measurements of coated pipes. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, the -850-mV instant off criterion, upper limit of -1200 mV, and use of soil corrosion probes are consistent with the acceptance criteria in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01. The staff's evaluation of the acceptability of using soil corrosion probes is documented above.

Enhancement 8. LRA Section B.2.1.28 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that it will "[c]onduct an extent of condition evaluation if observed coating damage caused by non-conforming backfill has been evaluated as significant. The extent of condition evaluation will be conducted to ensure that the as-left condition of backfill in the vicinity of the observed damage will not lead to further degradation." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, and finds it acceptable because, when it is implemented, it will be consistent with the extent of inspections for damage caused to coatings by backfill recommendations in GALL Report AMP XI.M41, as modified by LR-ISG-2015-01.

Based on its audit and review of the applicant's response to RAI B.2.1.28-1 and letter dated April 13, 2016, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M41, as modified by LR-ISG-2015-01. The staff reviewed the enhancement associated with the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.28 summarizes operating experience related to the Buried and Underground Piping program. Since January 2009, several segments of piping sections have been excavated for inspection in various systems including fire protection, condensate, RCIC, diesel oil transfer, and service water. Thirty to 40 guided wave inspections have been conducted. Permanent guided wave collars have been typically installed during excavations. Soil corrosion probes have also been installed in some locations. During the inspection of piping in three excavations conducted in 2011, it was determined that the coating was intact and performing well, the backfill quality was excellent, and there was no exposed substrate or corrosion of the piping. Since 2009, improvements to the cathodic protection system have been performed, including upgrading cathodic protection rectifiers; installing sacrificial anodes on the diesel generator fuel oil lines; conducting two soil samples and soil analyses; installing soil access ports to increase the accuracy of acquired data; installing several soil corrosion probes near safety-related pipes; installing several reference cells during buried pipe excavations to act as test points; and installing a new impressed-current system with anodes, rectifiers, and test points at the lake screen house.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M41, as modified by LR-ISG-2015-01, was evaluated.

UFSAR Supplement. As amended by letter dated April 13, 2016, LRA Section A.2.1.28 provides the UFSAR supplement for the Buried and Underground Piping program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0–1, as modified by LR-ISG-2015-01. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation and to complete inspections occurring prior to the period of extended operation no later than 6 months prior to the period of extended operation, or before the end of the last refueling outage prior to the period of extended operation, whichever is later. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Buried and Underground Piping program, the staff determines that those program elements for which the applicant claimed consistency with AMP XI.M41, as modified by LR-ISG-2015-01, are consistent. The staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 ASME Section XI, Subsection IWE

Summary of Technical Information in the Application. LRA Section B.2.1.29 describes the existing ASME Section XI, Subsection IWE program as consistent, with enhancements, with GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE." The LRA states that the program uses periodic visual and volumetric inspections to manage steel and stainless steel for loss of material, loss of preload, loss of leak tightness, and fretting or lockup. The program includes uncontrolled indoor air and treated water environments and includes components such as the containment liner plate and its integral attachments, downcomers and associated bracing, pressure-retaining bolting for containment closure, containment hatches, and other containment pressure-retaining components.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S1. For the "detection of aging effects" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI as discussed below.

The "detection of aging effects" program element in GALL Report AMP XI.S1 recommends surface examination to detect cracking in stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no CLB fatigue analysis. However, during its audit, the staff found that the applicant's ASME Section XI, Subsection IWE, does not include supplemental surface examinations to detect cracking in stainless steel penetration sleeves or dissimilar metal welds. By letter dated June 19, 2015, the staff issued RAI B.2.1.29-1, requesting that the applicant state whether it will perform supplemental surface examinations and, if not, provide a technical justification for relying on visual examination.

In its response dated July 15, 2015, the applicant stated that all penetration sleeve components subject to cyclic loading at LSCS have an associated CLB fatigue analysis. The applicant further stated that no containment penetration bellows exist at LSCS. Stainless steel penetration sleeves and dissimilar metal welds do exist at LSCS; however, the licensee noted that these are completely within the Reactor Building and are protected from a corrosive environment. Furthermore, the majority of the sleeves are embedded in the containment wall and are unavailable for surface examination. The applicant noted that 10 CFR Part 50, Appendix J, Type B testing is not possible on many of the mechanical penetration sleeves; however, the sleeves are subjected to 10 CFR Part 50, Appendix J, Type A testing.

The staff finds the applicant's response acceptable because the components have a fatigue analysis, the components are contained in a noncorrosive environment that generally precludes SCC, the applicant has no plant-specific operating experience with cracking of these components, and the components are subjected to 10 CFR Part 50, Appendix J, Type A testing and visual inspection under the ASME Section XI, Subsection IWE. Therefore, supplemental surface examinations are unnecessary. The staff's concern described in RAI B.2.1.29-1 is resolved.

The staff also reviewed the portions of the "preventive actions," and "monitoring and trending," 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.2.1.29 includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that guidance will be provided for proper specification for bolting material, lubricant and sealants, and installation torque to help mitigate degradation of structural bolting. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S1 and finds it acceptable because when it is implemented it will align the applicant's AMP with the guidance provided in the GALL Report AMP regarding proper selection of bolting materials.

Enhancement 2. LRA Section B.2.1.29 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that UT thickness measurements will be performed on the Unit 2 drywell liner at 0 and 180 degrees for several feet below elevation 813 feet, if leakage is detected from the reactor cavity pool drain line welds. The staff reviewed this enhancement and finds it acceptable because when it is implemented it will provide an acceptable method (UT thickness measurements) for detecting degradation of the liner due to leakage from the reactor cavity pool drain lines. The operating experience associated with this enhancement is discussed further in the operating experience section below.

Based on its audit, and review of the applicant's response to RAI B.2.1.29-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S1. In addition, the staff reviewed the enhancements associated with the "preventive actions," and "monitoring and trending," program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.29 summarizes operating experience related to the ASME Section XI, Subsection IWE program. A summary description of relevant operating experience that demonstrates that the inspections conducted under the program have been able to identify aging effects that are entered and evaluated in the corrective action program is provided below.

The LRA noted that, in 2006, two indications of corrosion were noted on the LSCS, Unit 1, drywell liner. This condition was entered into the corrective action program, and an engineering evaluation found the areas acceptable. In 2008, the areas were reinspected, including UT thickness measurements, with no changes identified. It was concluded that the areas were inactive and most likely resulted from initial construction.

The LRA also noted that, in 2010, a number of uncoated areas in the LSCS, Unit 1, drywell liner were found with light corrosion. The condition was entered into the corrective action program and found acceptable. However, the areas were coated to reduce future corrosion. The LRA noted that these examples demonstrate that the ASME Section XI, Subsection IWE program is effective in identifying degradation before loss of intended function.

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. 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 evaluated and incorporated operating experience related to this program.

The staff identified operating experience for which it determined the need for additional clarification, which resulted in the issuance of an RAI, as discussed below.

The LRA discusses leakage from the LSCS, Unit 2, reactor cavity pool drain line welds at the interface with the cavity pool liner, which has been observed as seepage through the surrounding concrete. As discussed in the Audit Report, the NRC staff reviewed an action request during the audit that identified indications of reactor cavity leakage in a different location from where it has been historically identified. By letter dated June 19, 2015, the staff issued RAI B.2.1.29-2, requesting that the applicant explain how the existing AMP and associated enhancement are adequate to address the new operating experience and why the proposed UT locations will be adequate.

In its response dated July 15, 2015, the applicant noted that the new leakage is at elevation 823 ft, approximately 9 ft above the previously identified source and above the primary containment drywell; therefore, it is unlikely to contact the containment drywell liner. In addition, the leakage is on the outside face of the concrete surrounding the reactor cavity pool liner, which is further away from the primary containment. The applicant noted that, even if water were to reach the drywell, industry operating experience indicates that corrosion will not occur because of the lack of oxygen in the region and because of the passivating effect on the leakage resulting from its passing through the highly alkaline 6-ft thick concrete wall. The applicant noted that the UT measurements were to confirm this fact and that measurements in 1999, 2005, and 2015 confirm that no loss of material has occurred. Furthermore, ASME Section XI, Subsection IWL inspections have been conducted on the surrounding concrete and no indications of concrete or reinforcing steel have been identified. The applicant further stated that the existing locations are the appropriate locations for UT measurements because they are along the same azimuth as the new leakage and at the thinnest location of the liner with the limiting thickness for detecting loss of material due to corrosion.

The staff notes that there are two possible concerns when addressing leakage near the primary containment. One concern is the possible impact of the leakage on the liner, and the other is the possible impact of the leakage on the surrounding concrete. The staff reviewed the applicant's response and noted that the applicant is addressing the possible impact on the liner by taking UT measurements at the most susceptible locations of the liner. The applicant is addressing the possible impact on the concrete by conducting the appropriate GALL Report recommended inspections. Neither of these inspections (the UT examinations or the concrete visual examinations) have identified indications of degradation. The staff finds the applicant's response acceptable because the applicant is conducting appropriate inspections that can identify degradation of the liner and the surrounding concrete. The staff's concern described in RAI B.2.1.29-2 is resolved.

Based on its audit and review of the application and review of the applicant's response to RAI B.2.1.29-2, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S1 was evaluated.

UFSAR Supplement. LRA Section A.2.1.29 provides the UFSAR supplement for the ASME Section XI, Subsection IWE program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation (Commitment No. 29). The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI, Subsection IWE 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 before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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 ASME Section XI, Subsection IWL

Summary of Technical Information in the Application. LRA Section B.2.1.30 describes the existing ASME Section XI, Subsection IWL program as consistent, with enhancements, with GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL." The LRA states that the AMP manages reinforced concrete and the unbonded post-tensioning system associated with the primary containment. The program uses general visual inspections to identify loss of material, cracking, and loss of bond of concrete. The LRA also notes that post-tensioning tendons are examined in accordance with the requirements of ASME Section XI, Subsection IWL.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S2. The staff also reviewed the portions of the "acceptance criteria" program element 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.2.1.30 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that areas of concrete deterioration and distress will be recorded in accordance with the guidance provided in American Concrete Institute (ACI) 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," dated June 2002. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S2 and finds it acceptable because, when it is implemented, it will align the applicant's program with the guidance in the GALL Report, which recommends using the guidance in ACI 349.3R for identification of concrete degradation.

Enhancement 2. LRA Section B.2.1.30 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that quantitative acceptance criteria based on the "Evaluation Criteria" in Chapter 5 of ACI 349.3R will be used to augment the qualitative assessment of the Responsible Engineer. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S2 and finds it acceptable because, when it is implemented, it will align the applicant's program with the guidance in the GALL Report, which recommends augmenting the qualitative assessment with quantitative acceptance criteria based on the guidance in ACI 349.3R.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S2. In addition, the staff reviewed the enhancements associated with the "acceptance criteria" program element and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.30 summarizes operating experience related to the ASME Section XI, Subsection IWL program. The LRA discusses a 2003 inspection that identified failed wires in an LSCS, Unit 1, vertical containment tendon. Additional inspections were done on LSCS, Units 1 and 2, to determine the extent of condition. A total of 12 additional tendons were found do have broken wires or internal corrosion and were replaced. The associated root cause determined that a poor upper grease cap design was allowing water into the tendons. A revised design with improved gaskets was installed on all of the susceptible vertical tendons, and subsequent inspections have demonstrated that the corrective actions were effective. The LRA also summarized the results of the recent concrete surface examinations for both containments. Conditions consistent with the baseline inspections were observed and determined to be minor with no structural significance or impact. A horizontal crack width measurement was different than previously identified, and it was reviewed and determined to be acceptable. These examples demonstrate that the existing program is effectively detecting and managing aging of the concrete containments.

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. 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 evaluated and incorporated operating experience related to this program. The Audit Report notes that the staff was considering issuing an RAI related to reactor cavity leakage; however, after further consideration, the staff determined an RAI was unnecessary. As discussed in LRA Section B.2.1.29, “ASME Section XI, Subsection IWE,” the cavity leakage is minor and only occurs during RFOs. Although the leakage does migrate through containment concrete, no degradation of the concrete has been detected to date, and the visual inspections in the applicant’s existing ASME Section XI, Subsection IWL program are adequate to monitor any future impacts of the leakage on the containment concrete. The impact of the leakage on the steel containment liner is addressed in the staff’s review of the ASME Section XI, Subsection IWE program (SER Section 3.0.3.2.15).

As noted above, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S2 was evaluated.

<u>UFSAR Supplement</u>. LRA Section A.2.1.30 provides the UFSAR supplement for the ASME Section XI, Subsection IWL program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

<u>Conclusion</u>. On the basis of its audit and review of the applicant’s ASME Section XI, Subsection IWL 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 before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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

UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 ASME Section XI, Subsection IWF

Summary of Technical Information in the Application. LRA Section B.2.1.31 describes the existing ASME Section XI, Subsection IWF program, with enhancements, as consistent with GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF." The LRA states that the AMP addresses ASME Class 1, 2, 3, and MC piping and component support members exposed to air-indoor uncontrolled and treated water environments to manage the aging effects of loss of material, loss of mechanical function, and loss of preload. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections to detect signs of degradation before loss of intended function. The LRA further states that bolting for supports is also included with these components and examined for loss of material and loss of preload by inspecting for missing, detached, or loosened bolts and nuts. Indications of degradation are entered in the corrective action program for evaluation or correction to ensure the intended function of the component support is maintained.

The LRA states that the program is based on the ASME Code Section XI, Subsection IWF, with edition and addenda and associated conditions determined for each inspection interval in accordance with 10 CFR 50.55a(g)(4); accordingly, the current program complies with the 2001 edition with 2003 addenda of ASME Code Section XI.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S3. For the "preventive actions" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "preventive action" program element in GALL Report AMP XI.S3 recommends use of bolting material that has an actual measured yield strength less than 150 ksi or 1,034 MPa, intended as a preventive measure against the potential for SCC. The staff noted that the "preventive actions" program element of LRA AMP B.2.1.31 included Enhancement 1 (Commitment No. 31, item 1) in order to become consistent with the corresponding GALL Report program element. However, during the audit, the staff found that Section 3.2, "Preventive Actions," in the LRA AMP program basis document states that high strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter are not used in LSCS IWF supports. The staff also noted that, on the basis of the previous statement, the "detection of aging effects" program element in Section 3.4 of the applicant's program basis document does not include the supplemental volumetric examination recommended in the "detection of aging effects" program element of the GALL Report AMP to detect cracking due to SCC, specifically for high strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter. From its wording, it was not clear to the staff whether Enhancement 1 (Commitment No. 31, item 1) is consistent with the "preventive action" program element of the GALL Report AMP XI.S3 with regard to the recommendation related to the use of bolting material that has an actual measured yield strength less than 150 ksi or 1,034 MPa. Specifically, because the enhancement does not prevent future use of high strength bolting material (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter that is susceptible to SCC and because the LRA AMP has no provisions for recommended supplemental volumetric examination of such bolting material, this aspect of the "preventive action" program element of the LRA AMP did not appear to be consistent with the GALL Report AMP.

By letter dated June 19, 2015, the staff issued RAI B.2.1.31-1, requesting that the applicant clarify how the proposed enhancement (Commitment No. 31, item 1) to the "preventive action" program element of LRA Section B.2.1.31, "ASME Section XI, Subsection IWF," is consistent with the corresponding program element recommendation of the GALL Report AMP XI.S3, specifically with regard to the future use of high strength bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than a 1-inch nominal diameter for IWF supports, considering that such bolting is susceptible to SCC and that the LRA AMP has no provisions for recommended supplemental volumetric examination to detect cracking if used in the future. Alternatively, the applicant was requested to provide the basis to justify the adequacy of the proposed exception to manage aging effects on high strength bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than a 1-inch nominal diameter for IWF supports if criteria other than that described in the GALL Report are being used.

In its response dated July 15, 2015, to RAI B.2.1.31-1, the applicant stated that LRA Enhancement 1 related to preventive actions for bolting associated with IWF supports is revised to preclude the potential for future use of high strength bolts due to consideration of SCC vulnerability by appending the enhancement with the following statement: "Bolting material with actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa, in sizes greater than a 1-inch nominal diameter shall not be used in supports for ASME Code Class 1, 2, and 3 piping and components or supports for MC components." The applicant stated that this revision to the enhancement makes the "preventive actions" program element of the LRA AMP consistent with that of the GALL Report AMP XI.S3; therefore no exception is taken to the GALL Report AMP. Accordingly, the applicant revised LRA Sections A.2.1.31, B.2.1.31, and Commitment No. 31 in LRA Section A.5 to incorporate the above revised wording into the enhancement.

The staff finds the applicant's response acceptable because the applicant's revised enhancement prevents the future use of high strength bolts (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than a 1-inch nominal diameter for IWF supports, thereby precluding the vulnerability of IWF support bolts to SCC, consistent with the recommendations of the GALL Report. The staff's concern described in RAI B.2.1.31-1 is resolved.

The staff also reviewed the portions of the "preventive actions" and "monitoring and trending" 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 follow.

Enhancement 1. LRA Section B.2.1.31, as amended by the applicant's letter dated July 15, 2015, in response to RAI B.2.1.31-1, includes an enhancement to the "preventive actions" program element. In this enhancement (Commitment No. 31, item 1), the applicant stated that before the period of extended operation, the program will be enhanced to "[p]rovide guidance for proper specification of bolting material, storage, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting. Requirements for high strength bolts shall include the preventive actions for storage, lubricants, and SCC potential discussed in Section 2 of RCSC (Research Council on Structural Connections) publication, 'Specification for Structural Joints Using ASTM A325 or A490 Bolts.'

Lubricants that contain molybdenum disulfide (MoS_2) shall not be applied to high strength bolts within the scope of license renewal. Bolting material with actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa, in sizes greater than 1 inch nominal diameter shall not be used in supports for ASME Class 1, 2, and 3 piping and components or supports for [Class] MC components." The staff reviewed this enhancement against the corresponding program element in the GALL Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will make the LRA AMP program element consistent with the recommendations in the GALL Report AMP by ensuring that proper specifications for structural bolting are used with regard to material, storage, lubricants, and installation to prevent or mitigate degradation and failure and to preclude susceptibility to SCC.

Enhancement 2. LRA Section B.2.1.31 includes an enhancement to the "monitoring and trending" program element. In this enhancement (Commitment No. 31, item 2), the applicant stated that before the period of extended operation it will "[p]rovide guidance, regarding the selection of supports to be inspected on subsequent inspections, when a support is repaired in accordance with the corrective action program. The enhanced guidance will ensure that the supports inspected on subsequent inspections are representative of the general population." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S3 and finds it acceptable because, when it is implemented, it will ensure that the inspection sample will adequately represent the age-related degradation of the IWF component population when components that are part of the sample are reworked or repaired and no longer represent the age-related degradation of the remaining population.

Based on its audit and review of the applicant's response to RAI B.2.1.31-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S3. In addition, the staff reviewed the enhancements associated with the "preventive action" and "monitoring and trending" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.31 summarizes operating experience related to the ASME Section XI, Subsection IWF program. A summary description of examples of operating experience that provide objective evidence that the ASME Section XI, Subsection IWF program will be effective in ensuring that intended functions are maintained consistent with the CLB for the period of extended operation is given below.

In 2013 during the ASME Section XI, Subsection IWF inservice inspection of an LSCS, Unit 2, ASME Code Class 1 rigid seismic restraint, a loose pipe clamp bolt was identified. A corrective action program issue report was initiated. The loose bolting was corrected, and required scope expansion examinations were performed on three additional supports in accordance with ASME Code Section XI, IWF-2430. During the ISI sample expansion examinations, a loose bolt was found on another pipe support. The loose bolting was corrected, and the examination scope was again expanded to include 11 additional supports in accordance with ASME Code Section XI, IWF-2430. During the ISI sample expansion examinations, another loose bolt was found on another pipe support. The loose bolting was corrected, and the examination scope was expanded in accordance with ASME Code Section XI, IWF-2430 (c), to the remaining supports on that pipe line, which are potentially subject to the same condition. The loose bolting identified would not have prevented the supports from performing their intended function. However, the scope of examinations was expanded to determine the extent of condition, and the loose bolting conditions identified were corrected. This example demonstrates that conditions, such as loose bolting, are identified and corrected and that additional supports are examined as required for similar conditions.

In 2012 during the ASME Section XI, Subsection IWF inservice inspection of an LSCS, Unit 1, ASME Code Class 1 feedwater pipe restraint, a loose pipe clamp bolt was identified. A corrective action program issue report was initiated. The loose bolting was corrected, and the required scope expansion examinations were performed in accordance with ASME Code Section XI, IWF-2430. Additional recordable indications were identified, and additional sample expansions were conducted so that every Class 1 support on the A and B feedwater lines were examined. This example demonstrates that conditions, such as loose bolting, are identified and corrected and that additional supports are examined as required for similar conditions. The inspection methods that the program implements have been proven effective in detecting aging effects, including loss of material, loss of mechanical function, and loss of preload. Appropriate guidance for evaluation, repair, or replacement is provided for locations where degradation is found. Problems identified, such as loose fasteners or loose lock nuts, would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to address these conditions. Periodic self-assessments of the ASME Section XI, Subsection IWF program are performed to identify the areas that need improvement to maintain the quality performance of the program. The program is informed and enhanced when necessary through the systematic and ongoing review of both plant-specific and industry operating experience. Therefore, there is confidence that implementation of the ASME Section XI, Subsection IWF program will effectively identify degradation before failure or loss of intended function during the period of extended operation.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S3 was evaluated.

UFSAR Supplement. LRA Section A.2.1.31 provides the UFSAR supplement for the ASME Section XI, Subsection IWF program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI, Subsection IWF program, as amended by the applicant's letter dated July 15, 2015, the staff determined 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 before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Masonry Walls

Summary of Technical Information in the Application. LRA Section B.2.1.33 describes the existing Masonry Walls program as consistent, with enhancements, with GALL Report AMP XI.S5, "Masonry Walls." The LRA states that the Masonry Walls program is a condition monitoring program implemented as part of the Structures Monitoring program and is based on the guidance provided in Inspection and Enforcement (IE) Bulletin 80-11, "Masonry Wall Design," dated May 8, 1980, and NRC IN 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11," dated December 31, 1987. The LRA also states that the program relies on periodic visual inspections of masonry walls exposed to air-indoor (uncontrolled) and air-outdoor environments on an interval not to exceed 5 years to monitor and maintain the condition of the walls so that the established design basis remains valid. The program inspects for loss of material and cracking and will be enhanced to inspect for separation and for gaps between the supports and masonry walls that could impact the intended function of the walls. The LRA further states that conditions found to be acceptable with deficiencies or that are deemed unacceptable are evaluated and/or corrected by repair/replacement in the corrective action program. Masonry walls that are considered fire barriers are also managed by the Fire Protection program, which is evaluated in SER Section 3.0.3.2.9.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S5. For the "parameters monitored or inspected" and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "parameters monitored or inspected" and "acceptance criteria" program elements in GALL Report AMP XI.S5 recommends that the primary parameters monitored are potential shrinkage and/or separation and cracking of masonry walls and gaps between the supports *and* masonry walls that could impact the intended function or potentially invalidate its evaluation basis. However, during its audit, the staff found that Enhancement 1 (Commitment No. 33, item 1) to the applicant's Masonry Wall program states that, before the period of extended operation, the program will be revised to "provide guidance for inspection of masonry walls for separation, and for gaps between the supports *for* masonry walls." In this regard, the critical parameter intended to be monitored, as evaluated in the GALL Report AMP, are gaps between the masonry walls and component supports (i.e., supports for safety-related systems or components that are located in close proximity to, or have attachments to, the walls, or edge supports that establish boundary conditions used in the design analysis of the walls) to ensure that intended function and/or evaluation basis of the masonry wall is not adversely impacted. This is different from the parameter described as "gaps between supports *for* masonry walls" in the LRA AMP enhancement.

By NRC letter dated June 19, 2015, the staff issued RAI B.2.1.33-1, requesting that the applicant clarify how the enhancement for the "parameters monitored or inspected" and "acceptance criteria" program elements is consistent with that described in the GALL Report

AMP XI.S5 with regard to monitoring for gaps between supports and masonry walls and, if parameters or criteria different than that described in the GALL Report are being used, provide the basis to justify the adequacy of the proposed exception to manage the aging effects to masonry walls.

In its response dated July 15, 2015, the applicant stated that Enhancement 1, associated with Commitment No. 33, is revised for the wording to be consistent with the GALL Report AMP XI.S5 "parameters monitored or inspected" and "acceptance criteria" program elements. The applicant also stated that the above revision is consistent with the GALL Report AMP XI.S5 and that no exception to the GALL Report is required.

The staff finds the applicant's response acceptable because the revised wording for the program enhancement is consistent with the GALL Report recommended parameters monitored or inspected and acceptance criteria for shrinkage and/or separation and cracking of masonry walls and gaps between the supports and masonry walls. The staff's concern described in RAI B.2.1.33-1 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected," "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.2.1.33, as amended by the response dated July 15, 2015, to RAI B.2.1.33-1, includes an enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements. In this enhancement (Commitment No. 33, item 1), the applicant stated that, before the period of extended operation, the program procedures will be revised to "provide guidance for inspection of masonry walls for separation and gaps between the supports and masonry walls." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will make the program consistent with the GALL Report recommended parameters monitored or inspected and acceptance criteria for shrinkage and/or separation and cracking of masonry walls and gaps between the supports and masonry walls that could impact the intended function or potentially invalidate its evaluation basis.

Enhancement 2. LRA Section B.2.1.33 includes an enhancement to the "detection of aging effects" program element. In this enhancement (Commitment No. 33, item 2), the applicant stated that, before the period of extended operation, the program procedures will be revised to "require that personnel performing inspections and evaluations meet the qualifications described in ACI 349.3R." As observed in the Audit Report, the applicant's program basis document for Structures Monitoring lists the 2002 version of ACI 349.3R. Because the Masonry Walls program is implemented as part of the Structures Monitoring program, this enhancement to the Masonry Walls program, related to personnel qualifications, will be based on the 2002 version of ACI 349.3R, which is consistent with the version of ACI 349.3R referenced in the GALL Report AMP XI.S6. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S5 and finds it acceptable because, when it is implemented, it will ensure personnel performing visual inspections of masonry walls meet the qualification requirements described in ACI 349.3R as recommended by the GALL Report.

Based on its audit and review of the applicant's response to RAI B.2.1.33-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report

AMP XI.S5. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.33 summarizes operating experience related to the Masonry Walls program. A summary description of relevant operating experience that demonstrates that inspections similar to those conducted under the program have been able to identify aging effects, which are entered and evaluated in the corrective action program to determine appropriate corrective actions, is provided below.

A 2004 walkdown of plant structures, including masonry walls, following a recorded seismic event, identified minor cracking and loose mortar on removable block walls in the turbine building. The walkdown results were documented and subjected to an engineering evaluation within the corrective action program. The mortar joints were repaired, and the engineering evaluation found the minor cracking along the joints of the removable block walls to be acceptable.

During a 2011 walkdown of fire barriers, a small localized area of missing mortar was identified on a joint between two concrete blocks located on the east masonry wall of the auxiliary equipment room. The condition was documented in the corrective action program, and an engineering evaluation of the condition determined that it did not affect the design function of the masonry wall nor the ability of the wall to maintain its function as a fire barrier; therefore, repair was not required.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S5 was evaluated.

UFSAR Supplement. LRA Section A.2.1.33, as revised by the applicant's letter dated July 15, 2015, provides the UFSAR supplement for the Masonry Walls program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the Masonry Walls program before the period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated July 15, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Masonry Walls program, as revised by its letter dated July 15, 2015, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Structures Monitoring

Summary of Technical Information in the Application. LRA Section B.2.1.34 describes the existing Structures Monitoring program as consistent, with enhancements, with GALL Report AMP XI.S6, "Structures Monitoring." The LRA states that the Structures Monitoring program was developed to implement the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and is based on guidance in RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, dated March 1997, and NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Revision 2, dated April 1996. The AMP includes elements of the Masonry Wall program (LRA Section B.2.1.33) and the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program (LRA Section B.2.1.35). The staff's evaluations of these AMPs are documented in SER Sections 3.0.3.2.18 and 3.0.3.2.20, respectively.

The LRA states that concrete structures are inspected for indications of deterioration and distress, including evidence of leaching, loss of material, cracking, and a loss of bond, and steel components are inspected for loss of material due to corrosion. Environments include air-outdoor, air-indoor uncontrolled, treated water, raw water, water-flowing, and groundwater and soil. The LRA also states that the AMP proposes to manage these aging effects through periodic inspection and monitoring of 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. The LRA further states that inspections are performed on a frequency not to exceed 5 years with provisions for more frequent inspections when conditions are observed to have a potential impact in its intended function. The AMP includes provisions for periodic sampling and testing of groundwater on a 5-year frequency to ensure the groundwater remains nonaggressive.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S6. For the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "detection of aging effects" program element in GALL Report AMP XI.S6 recommends that plants with nonaggressive groundwater/soil environment (a) evaluate 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 and (b) examine representative samples of the exposed portions of the below-grade concrete when excavated for any reason. However, during its audit, the staff found that Enhancement 7, applicable to the "detection of aging effects" program element, of the applicant's Structures Monitoring program only addresses item b above of the GALL Report recommendations. By letter dated June 19, 2015, the staff issued RAI B.2.1.34-1, requesting that the applicant clarify how the enhancement for the program element is consistent with that described in the GALL Report AMP XI.S6 and, if criteria other than that described in the GALL Report are being used, provide the basis to justify the adequacy of the proposed exception to manage the aging effects in inaccessible areas.

In its response dated July 15, 2015, the applicant stated that LRA Enhancement 7, associated with Commitment No. 34, is revised to include the requirement that an evaluation needs to be performed for inaccessible concrete surfaces when accessible concrete areas show signs of aging degradation. The applicant also stated that the revision to this enhancement is consistent with the criteria for the “detection of aging effects” program element in GALL Report AMP XI.S6; therefore, no exception is required.

The staff finds the applicant’s response acceptable because the revised LRA Enhancement 7, associated with Commitment No. 34, is consistent with the GALL Report AMP XI.S6 recommendations for “detection of aging effects” in plants with a nonaggressive groundwater/soil environment. The staff’s concern described in RAI B.2.1.34-1 is resolved.

The “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements in GALL Report AMP XI.S6 does not provide recommendations for managing the aging effects of plant-specific components. During its audit, the staff noted that the applicant’s Structures Monitoring program is enhanced to include “permanent drywell shielding” as a plant-specific component within the scope of the AMP. However, the staff found that no enhancement(s) to the applicable program elements was provided to ensure that the aging effects associated with “fiberglass blanket covers for permanent drywell shielding” is adequately managed during the period of extended operation. The staff also found an inconsistency between the aging effect described as being managed by the associated LRA Table 3.5.2-7 AMR results item (LRA page 3.5-160) and the aging effect identified in the corresponding plant-specific note 3 (“change in material properties” versus “rips and tears”). By letter dated June 19, 2015, the staff issued RAI B.2.1.34-2, requesting that the applicant explain how the enhancement to the “scope of program” program element is adequate to manage aging effects for “permanent drywell shielding” without providing a corresponding enhancement(s) to other applicable program elements or provide the necessary enhancement, as needed, to adequately manage the applicable aging effects of the plant-specific component. The staff’s RAI also requested that the applicant describe the aging effect(s) and aging mechanism that will be managed by the AMP for the permanent drywell shielding fiberglass blanket covers and clarify the inconsistency between the aging effect described in the LRA Table 3.5.2-7 AMR results item and the corresponding plant-specific note 3.

In its response dated July 15, 2015, the applicant stated that LRA Enhancement 10, associated with Commitment No. 34, is added to the LRA to ensure that the fiberglass blanket covers associated with permanent drywell shielding are properly managed during the period of extended operation by the Structures Monitoring program. The applicant also stated that the aging effect identified in LRA Table 3.5.2-7, change in material properties due to irradiation and thermal exposure, was selected to align with an appropriate GALL Report aging effect and AMR results and that the plant-specific note was used to define “rips and tears” as the type of change in material properties that is associated with the fiberglass blankets that will be managed by the Structures Monitoring program. The applicant further stated that the Structures Monitoring program is enhanced to inspect for signs of rips and tears for these fiberglass blanket covers and that, if a rip or tear is found, the permanent drywell shielding will be repaired or replaced.

The staff finds the applicant’s response acceptable because the applicant added LRA Enhancement 10 that will provide the necessary parameters to the “parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements of the LRA AMP to ensure that the aging effects for permanent drywell shielding are adequately managed during the period of extended operation. The applicant also clarified the inconsistency between the aging effect described in LRA Table 3.5.2-7 AMR results item and the corresponding plant-specific note 3. The staff's concern described in RAI B.2.1.34-2 is resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "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.2.1.34 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the AMP will be enhanced to include the monitoring of the following components and commodities:

- pipe, electrical, and equipment component support members
- pipe whip restraints and jet impingement shields
- panels, racks, cabinets, and other enclosures
- sliding surfaces
- sumps
- electrical cable trays and conduits
- electrical duct banks
- tube tracks
- transmission tower (including takeoff towers) and foundation (including cycled condensate storage tank foundations)
- penetration seals and sleeves
- blowout panels
- permanent drywell shielding
- transformer foundation
- bearing pads
- compressible joints
- hatches, plugs, handholes, and manholes
- metal components (decking, vent stack, and miscellaneous steel)
- building features – doors and seals, bird screens, louvers, windows, and siding
- concrete curbs and anchors
- Turbine Building smoke and heat vent housings

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will address additional site structures within the scope of license renewal that are not covered by other structural AMPs. This enhancement makes the applicant's "scope of program" program element consistent with the recommendations provided in GALL Report AMP XI.S6 in that it will help monitor and assess the impact of age-related degradation on these structures and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 2. LRA Section B.2.1.34 includes an enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that the AMP will be enhanced to provide guidance for proper specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will provide preventive actions as delineated in NUREG-1339 and other industry standards as recommended by the GALL Report to ensure bolting integrity.

Enhancement 3. LRA Section B.2.1.34 includes an enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that the AMP’s storage requirements for high strength bolts will be revised to include recommendations in Section 2 of Research Council on Structural Connections (RCSC), “Specification for Structural Joints Using American Society for Testing and Materials (ASTM) A325 or A490 Bolts.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will include preventive actions from industry guidelines for storage of ASTM A325 and ASTM A490 structural bolts as recommended by the GALL Report to ensure bolting integrity.

Enhancement 4. LRA Section B.2.1.34 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that the AMP will be enhanced to require acceptance and evaluation of structural concrete using quantitative criteria based on Chapter 5 of ACI 349.3R. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will provide quantitative acceptance criteria using industry standards that allow the determination for adequacy of observed aging effects and will specify further evaluation criteria to determine the need for corrective actions based on the industry guidelines as recommended by the GALL Report.

Enhancement 5. LRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected” and “detection of aging effects” program elements. In this enhancement, the applicant stated that the AMP will be enhanced to monitor raw water and groundwater chemistry on a frequency not to exceed 5 years for pH, chlorides, and sulfates and to verify that it remains nonaggressive or to evaluate results exceeding criteria to assess impact, if any, on below-grade concrete. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will allow the applicant to assess the impact of the groundwater on below-grade concrete structures by monitoring the groundwater chemistry. This enhancement makes the applicant’s “parameters monitored or inspected” and “detection of aging effects” program elements consistent with the recommendations provided in GALL Report AMP XI.S6.

Enhancement 6. LRA Section B.2.1.34 includes an enhancement to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements. In this enhancement, the applicant stated that the AMP will be enhanced to monitor concrete for increase in porosity and permeability and to inspect accessible sliding surfaces for indication of significant loss of material due to wear or corrosion, debris, or dirt. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will allow detection of deterioration that could impact the intended function of the concrete structures and accessible sliding surfaces. This enhancement makes the applicant's "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements consistent with the recommendations provided in GALL Report AMP XI.S6.

Enhancement 7. LRA Section B.2.1.34, as amended by the applicant's response letter dated July 15, 2015, to RAI B.2.1.34-1, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the program will be enhanced to "evaluate 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, and examine representative samples of the exposed portions of the below-grade concrete, when excavated for any reason." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will be able to provide detection of aging effects for inaccessible concrete structural elements in a manner consistent with the GALL Report recommendations for plants with a nonaggressive groundwater/soil environment.

Enhancement 8. LRA Section B.2.1.34 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that personnel performing inspections and evaluations will be required to meet the qualifications specified within ACI 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will ensure that inspections and evaluations are performed by personnel that meet the qualification requirements of ACI 349.3R, as recommended by the GALL Report.

Enhancement 9. LRA Section B.2.1.34 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the AMP will be clarified to indicate that loose bolts and nuts and cracked high strength bolts are not acceptable unless accepted by engineering evaluations. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and finds it acceptable because, when it is implemented, it will require an engineering evaluation for the acceptance of loose bolts and nuts and cracked high strength bolts, as recommended by the GALL Report.

Enhancement 10. LRA Section B.2.1.34, as amended by the applicant's response letter dated July 15, 2015, to RAI B.2.1.34-2, includes enhancements to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that the AMP will be enhanced to do the following: "Inspect the fiberglass outer covering for the permanent drywell shielding for signs of rips and tears. If a rip or tear is found, repair or replace the permanent drywell shielding." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S6 and notes that fiberglass blanket covers from shielding components are plant-specific components that are not addressed by the GALL Report recommendations. However, the staff finds this enhancement acceptable because, when it is implemented, it will ensure that the AMP has the necessary parameters to be inspected, a procedure for the detection of aging effects, and acceptance criteria associated with plant-specific components to ensure that their intended function is maintained during the period of extended operation.

Based on its audit and review of the applicant's response(s) to RAIs B.2.1.34-1 and B.2.1.34-2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S6. In addition, the staff reviewed the enhancements associated with the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.34 summarizes operating experience related to the Structures Monitoring program. A summary description of relevant operating experience that demonstrates that the inspections similar to those conducted under the program have been able to identify aging effects, which are entered and evaluated in the corrective action program to determine appropriate corrective actions, is provided below.

In 2010, inspection of the reactor building structural steel identified connections that were not in accordance with design requirements; a clip angle at one connection was separated from the column web, and another connection contained three loose bolts. The applicant entered both identified conditions into its corrective action program for evaluation and corrected the gap between the clip and beam on the column. The bolted connection was tightened in accordance with design requirements.

In 2010, a fire door was found with a loose bottom seal during a Structures Monitoring program walkdown. The applicant entered the identified condition into their corrective action program for evaluation and corrected the condition by retightening the loose door seal.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S6 was evaluated.

UFSAR Supplement. LRA Section A.2.1.34, as amended by the applicant's response letter dated July 15, 2015, to RAIs B.2.1.34-1 and B.2.1.34-2, provides the UFSAR supplement for the Structures Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the Structures Monitoring program before the period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated July 15, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Structures Monitoring program, as amended by the applicant's letter dated July 15, 2015, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants

Summary of Technical Information in the Application. LRA Section B.2.1.35 describes the existing RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, as consistent, with enhancements, with GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The LRA states that the AMP is implemented as part of the Structures Monitoring program (LRA Section B.2.1.34) and is consistent with the guidance provided in RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," Revision 1, dated March 1978.

The LRA also states that the AMP addresses age-related degradation, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect the safety function of the water-control structures. The LRA further states that aging effects are managed through periodic visual inspections and surveillance programs to detect degradation and to take corrective actions to prevent the loss of their intended function. The program monitors structural components and commodities like reinforced concrete, bolting and structural steel, steel components (hatches/plugs), trash bar racks, sheet piling, shad net components, and earthen sides structures of the intake flume canal to manage the aging effects loss of material, loss of preload, cracking, increase in porosity and permeability, loss of strength, loss of material (spalling and scaling), and loss of form. Environments include air-indoor uncontrolled, air-outdoor, raw water, water-standing, water-flowing, groundwater, and soil.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.S7. For the "scope of program" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "scope of program" program element in GALL Report AMP XI.S7 recommends including in the scope of the program those concrete structures, structural steel, structural bolting, and other raw water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants. However, during its audit, the staff found that the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program enhances the scope of the AMP to include "shad net anchors" without clearly identifying the different materials and components associated with the structure (i.e., the steel anchor elements and the concrete piers) and the different aging effects and parameters that must be monitored or inspected to ensure that their intended function(s) is maintained during the period of extended operation. By NRC letter dated June 19, 2015, the staff issued RAI B.2.1.35-1, requesting that the applicant clarify how the enhancement to the "scope of program" program element is consistent with that described in the GALL Report AMP XI.S7 to ensure that the aging effects of in-scope components are being adequately managed, describe the different materials and components associated with the "shad net anchors," and describe the differences in the parameters to be monitored or inspected considering the different materials (e.g., steel and concrete) or components associated with "shad net anchors."

In its response dated July 15, 2015, the applicant stated that Enhancement 1 in LRA Section B.2.1.35, associated with Commitment No. 35, will ensure monitoring and inspection of the different materials because the galvanized steel "concrete embedment" are covered under item 1.c of the enhancement and because the "concrete shad net anchors" are addressed under item 1.d of the enhancement. The applicant also stated that the concrete shad net anchors will be managed by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program and the Structures Monitoring Program and that the galvanized steel concrete embedments will be managed by the Structures Monitoring Program. The applicant further stated that the reinforced concrete walls used to secure the shad net across the cooling lake intake flume are identified as "shad net anchors" on LSCS documentation; therefore, the same nomenclature was used in the LRA. The applicant clarified that these reinforced concrete walls have galvanized steel embedments in the concrete used as attachment points to secure the shad net. The concrete shad net anchors are included in LRA Table 3.5.2-3 (LRA page 3.5-105) as component type "Concrete: Shad Net Anchors"; the galvanized steel concrete embedments are included in LRA Table 3.5.2-3 (LRA page 3.5–103) as component type "Concrete Embedments."

The staff finds the applicant's response acceptable because the applicant clarified that the concrete and steel components of the shad net anchors were already included in the enhancement and LRA Table 3.5.2-3 and that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program and the Structures Monitoring Program will adequately manage the aging effects for the galvanized steel and concrete materials associated with the "shad net anchors," as recommended in the GALL Report. The staff's concern described in RAI B.2.1.35-1 is resolved.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "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.2.1.35 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the AMP will be enhanced to include the monitoring of the following SCs:

- Submerged Core Standby Cooling System Pond and Intake Flume
- Core Standby Cooling System outfall structure
- Bar racks and miscellaneous steel
- Shad net anchors
- Lake Screen House (includes service water tunnel)

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will include additional structures, structural components, component supports, and structural commodities related to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants that are within the scope of license renewal. This enhancement makes the applicant's "scope of program" program element consistent with the recommendations provided in GALL Report AMP XI.S7 in that it will help monitor and assess the impact of age-related degradation on these water-control structures and structural components and will provide assurance that the aging degradation can be detected and quantified before there is a loss of intended functions.

Enhancement 2. LRA Section B.2.1.35 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the AMP will be enhanced to monitor raw water and groundwater chemistry for pH, chlorides, and sulfates at least once every 5 years, and to verify that it remains nonaggressive or evaluate results exceeding criteria to assess impact, if any, on buried or submerged concrete. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will allow the applicant to assess the impact of the groundwater on below-grade concrete of water-control structures by monitoring the groundwater chemistry. This enhancement makes the applicant's "detection of aging effects" program element consistent with the recommendations provided in GALL Report AMP XI.S7.

Enhancement 3. LRA Section B.2.1.35 includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that the AMP will be enhanced to provide guidance for proper specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting and to provide preventative actions for storage of materials to prevent SCC. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will provide preventive actions as delineated in NUREG-1339 and other industry standards, as recommended by the GALL Report to ensure bolting integrity.

Enhancement 4. LRA Section B.2.1.35 includes an enhancement to the "parameters monitored or inspected" and "acceptance criteria" program elements. In this enhancement, the applicant stated that the AMP will be enhanced to require acceptance and evaluation of structural concrete using quantitative criteria based on Chapter 5 of ACI 349.3R. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will provide quantitative acceptance criteria using industry standards that allow the determination for adequacy of observed aging effects and will specify further evaluation criteria to determine the need for corrective actions based on the industry guidelines, as recommended by the GALL Report.

Enhancement 5. LRA Section B.2.1.35 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the AMP will be enhanced to require the inspection of accessible in-scope portions of the cooling lake and lake screen house immediately following the occurrence of significant natural phenomena, which include intense local rainfalls and large floods. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will be consistent with the GALL Report recommendation to address degradation due to extreme environmental conditions and the effects of natural phenomena that may affect water control structures.

Enhancement 6. LRA Section B.2.1.35 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the AMP will be enhanced to require (a) the evaluation of the acceptability of inaccessible areas when conditions exist in the accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas and (b) the examination of the exposed portions of the below-grade concrete when excavated for any reason. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S7 and finds it acceptable because, when it is implemented, it will be able to provide detection of aging effects for inaccessible concrete structural elements in a manner consistent with the GALL Report recommendations for plants with nonaggressive groundwater/soil.

Based on its audit and review of the applicant's response to RAI B.2.1.35-1, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.S7. In addition, the staff reviewed the enhancements associated with "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.35 summarizes operating experience related to the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program. A summary description of relevant operating experience that demonstrates that the inspections, similar to those conducted under the program, have been able to identify aging effects, which are entered and evaluated in the corrective action program to determine appropriate corrective actions, is provided below.

In 2009, inspections of the service water tunnel in the lake screen house identified spalling concrete on the floor of the service water tunnel, which exposed reinforcing steel. This condition was entered into the applicant's corrective action program for evaluation. The engineering evaluation concluded that immediate repairs were not necessary and that the degradation should be monitored during subsequent inspections until repaired. Subsequent inspections has not identified any further degradation of these components.

In 2009, chemical analysis of the lake water determined that pH levels of the lake water had dropped below the administrative water chemistry guidelines. This condition was corrected by readjusting the water chemistry to restore the pH to a level greater than 8.8.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.S7 was evaluated.

UFSAR Supplement. LRA Section A.2.1.35 provides the UFSAR supplement for the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the enhancements to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. The staff concluded 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 UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Metal Enclosed Bus

Summary of Technical Information in the Application. LRA Section B.2.1.40 describes the existing Metal Enclosed Bus program as consistent, with enhancements, with GALL Report AMP XI.E4, "Metal Enclosed Bus." The LRA states that the AMP is an existing condition monitoring program that will be enhanced to manage the identified aging effects of in-scope metal enclosed bus (MEB). The LRA will inspect MEB metallic components, including MEB bolted connections, insulators and supports, and the internal and external surfaces of the MEB enclosure assembly exposed to air-outdoor and air-indoor controlled or uncontrolled environments. The MEB aging effects identified by the applicant are stated to include hardening, loss of strength, increased resistance of connection, reduced insulation resistance, and loss of material. The LRA also states that the AMP proposes to manage these aging effects through the condition monitoring actions that include the following:

- External surfaces are visually inspected for loss of material due to general, pitting, and crevice corrosion.
- Accessible enclosure assembly elastomers are visually inspected for surface cracking, crazing, scuffing, dimensional change, shrinkage, discoloration, hardening, and loss of strength.
- Accessible internal bus insulating supports are visually inspected for structural integrity and signs of cracks.
- A sample of accessible bolted connections is inspected for increased resistance of connection by thermography imaging or by measuring the connection resistance using a micro-ohmmeter.

The LRA states that plant operating experience provides objective evidence that the program will be effective in ensuring that intended functions are maintained consistent with the CLB 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.E4.

The staff also reviewed the portions of the "parameters monitored or inspected," "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.2.1.40 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements. In this enhancement, the applicant stated that internal inspections will be performed for accessible nonsegregated bus duct sections that are in scope for license renewal. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.E4 and finds it acceptable because, when it is implemented, it will specify that in-scope MEB portions are covered under this AMP.

Enhancement 2. LRA Section B.2.1.40 includes an enhancement to the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. In this enhancement, the applicant stated that the requirement for visual inspections of internal portions (bus enclosure assemblies), bus insulation, internal bus insulating supports, accessible gaskets, boots and sealants, and bus duct external surfaces will be clarified. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.E4 and finds it acceptable because, when it is implemented, it will include visual inspection guidance for various MEB elements consistent with the GALL Report.

Enhancement 3. LRA Section B.2.1.40 includes an enhancement to the "detection of aging effects" and "acceptance criteria" program elements. In this enhancement, the applicant stated that the existing program will be enhanced to specify that a sample size of 20 percent of the accessible bolted connection population, with a maximum sample size of 25, will be inspected for increased resistance of connection by either thermography or by measuring the connection resistance using a micro-ohmmeter. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.E4 and finds it acceptable because, when it is implemented, it will specify the sample size for testing of accessible bolted connections consistent with the GALL Report.

Enhancement 4. LRA Section B.2.1.40 includes an enhancement to the "detection of aging effects" and "acceptance criteria" program elements. In this enhancement, the applicant stated that an inspection frequency of at least every 10 years will be specified. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.E4 and finds it acceptable because, when it is implemented, it will specify the inspection frequency consistent with the GALL Report.

Based on its audit, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.E4. In addition, the staff reviewed the enhancements associated with the "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.2.1.40 summarizes operating experience related to the Metal Enclosed Bus program. The LRA cites that, in October 2008 during the inspection of an isophase bus duct, a damaged insulator was discovered. The broken insulator was repaired under the applicant's corrective action program. Subsequent to this event, a similar failure was noted at another Exelon plant. As a result, the applicant implemented a hi-pot testing frequency of every 6 years for isophase and nonsegregated bus ducts. In another example, the LRA describes an event in November 2009 when Significant Event Report 5-09 was issued at another plant for a failure of a 6.9-kV nonsegregated bus. Although the applicant had not experienced a similar failure with the MEB, additional hi-pot testing and torque checks were added to the program. The applicant stated that these examples demonstrate that the program has been able to identify aging effects and that corrective actions were taken under the program to prevent the recurrence of component failures.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.E4 was evaluated.

UFSAR Supplement. LRA Section A.2.1.40 provides the UFSAR supplement for the Metal Enclosed Bus program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed (Commitment No. 40) to enhance the existing Metal Enclosed Bus program before the period of extended operation for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Metal Enclosed Bus 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 before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.22 Fatigue Monitoring

Summary of Technical Information in the Application. LRA Section B.3.1.1 describes the existing Fatigue Monitoring program as consistent, with enhancements, with GALL Report AMP X.M1, "Fatigue Monitoring." The LRA states that the AMP manages fatigue damage of reactor coolant pressure boundary and other components subject to the reactor coolant, treated water, steam, and air-indoor uncontrolled environments. The Fatigue Monitoring program monitors and tracks the number of critical thermal, pressure, and seismic transients to ensure that the cumulative usage factor for each analyzed component does not exceed the design limit of 1.0 through the period of extended operation. The program accomplishes this by (a) comparing the actual event parameters to the applicable design transient definitions to ensure the actual transients are bounded by the design transients, (b) counting the operational transients to ensure that the cumulative number of occurrences of each transient type is maintained below the most limiting cycle limit, and (c) considering the effects of the reactor coolant environment on fatigue life of Class 1 components that contact reactor coolant.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP X.M1. The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," 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 follows.

Enhancement 1. LRA Section B.3.1.1 includes an enhancement to the "scope of program," "preventive actions," "parameters monitored or inspected," and "acceptance criteria" program elements. In this enhancement, the applicant stated that it will impose administrative transient cycle limits corresponding to the limiting numbers of cycles used in the environmental fatigue calculations.

The "scope of program" program element of GALL Report AMP X.M1 states that the program monitors and tracks the number of critical thermal and pressure transients and ensures that the fatigue usage will remain within the allowable limit. The "preventative actions" program element of GALL Report AMP X.M1 states that the program prevents the fatigue analyses from becoming invalid by ensuring that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0, including environmental effects where applicable. The "parameters monitored or inspected" program element of GALL Report AMP X.M1 states that the program monitors all plant design transients that cause cyclic strains and that are significant contributors to the fatigue usage factor. The "acceptance criteria" program element of GALL Report AMP X.M1 states that the program maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. As discussed in LRA Section 4.3.3, the applicant evaluated the effects of the reactor water environment on the fatigue life of Class 1 components that contact reactor coolant. The LRA states that if more limiting cycle limits are identified during its environmental fatigue analyses than the current cycle limits used in its 40-year design analyses, the enhanced program will apply the more limiting cycle limits for the applicable transients. The program will apply corrective actions to prevent the cumulative number of occurrences of each transient from exceeding the cycle limits.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP X.M1 and finds it acceptable because, when implemented, the applicant will (a) conservatively apply the most limiting cycle limits for the thermal and pressure transients that significantly contribute to the fatigue usage factor and (b) ensure, through monitoring, tracking, and applying corrective actions, that the fatigue usage will remain within the allowable limit through the period of extended operation. When the enhancement is implemented, the applicant's program will be consistent with the recommendations of the GALL Report, as described above.

Enhancement 2. LRA Section B.3.1.1 includes an enhancement to the "preventive actions," "parameters monitored or inspected," and "acceptance criteria" program elements. In this enhancement, the applicant stated that the impact of the reactor coolant environment will be evaluated on Class 1 components, including valves and pumps if they are more limiting than those considered in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," dated February 1995.

The "preventative actions" program element of GALL Report AMP X.M1 states that the program prevents the fatigue analyses from becoming invalid by ensuring that the fatigue usage resulting from actual operational transients does not exceed the Code design limit of 1.0, including environmental effects where applicable. The "parameters monitored or inspected" program element of GALL Report AMP X.M1 states that the program monitors all plant design transients that cause cyclic strains and that are significant contributors to the fatigue usage factor. The "acceptance criteria" program element of GALL Report AMP X.M1 states that the program maintains the cumulative fatigue usage below the design limit through the period of extended operation, with consideration of the reactor water environmental fatigue effects. LRA Section 4.3.3 provides the applicant's TLAA for evaluating the effects of the reactor water environment on the fatigue life of Class 1 components that contact reactor coolant. As part of its evaluation, the applicant will identify any component locations that are determined to be more limiting than those listed in NUREG/CR-6260 for the plant type and vintage.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP X.M1 and finds it acceptable because, when implemented, the program will consider the effects of the reactor coolant environment for the locations identified in NUREG/CR-6260 and any additional plant-specific locations that are determined to be more limiting. When the enhancement is implemented, the applicant's program will be consistent with the recommendations of the GALL Report, as described above.

Operating Experience. LRA Section B.3.1.1 summarizes operating experience related to the Fatigue Monitoring program. The LRA includes examples of operating experience that provide objective evidence that the Fatigue Monitoring program will be effective in identifying degradation before loss of intended function through the period of extended operation. The applicant stated that these examples show that the Fatigue Monitoring program (a) effectively monitors and trends the conditions that impact the fatigue life of plant components and (b) is informed and enhanced when necessary through systematic and ongoing review of both plant-specific and industry operating experience.

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP X.M1 was evaluated.

UFSAR Supplement. LRA Section A.3.1.1 provides the UFSAR supplement for the Fatigue Monitoring program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to ongoing implementation of the existing Fatigue

Monitoring program for managing the effects of aging for applicable components during the period of extended operation. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Fatigue 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 enhancements and confirmed that their implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.23 Concrete Containment Tendon Prestress

Summary of Technical Information in the Application. LRA Section B.3.1.2 describes the existing Concrete Containment Tendon Prestress program, with an enhancement, as consistent with GALL Report AMP X.S1, "Concrete Containment Tendon Prestress." The LRA states that the AMP addresses carbon steel tendons of the containment prestressing system exposed to an air-indoor uncontrolled environment to manage the effects of loss of containment tendon prestressing forces. The LRA also states that the AMP proposes to manage this aging effect by conducting periodic measurements of prestressing forces on a control tendon and a randomly selected sample of tendons for each tendon group used (i.e., vertical and horizontal (hoop) tendon types) and by assessing them against acceptance criteria (predicted lower limit (PLL) value and minimum required value (MRV)) and evaluating trend lines of the measured forces; corrective actions are taken if unacceptable results or trends are identified.

The LRA states that the program is based on ASME Code Section XI, Subsection IWL, with edition and addenda and associated conditions determined for each inspection interval in accordance with the requirements in 10 CFR 50.55a(g)(4); the edition for the current program is the 2001 edition with the 2003 addenda. The LRA states that the PLL for tendons is developed consistent with the guidance in RG 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," dated July 1990, and the trend lines are constructed by regression analysis of individual measured tendon forces consistent with NRC IN 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," dated October 7, 1999. The LRA states that if individual tendon forces remain above 95 percent of predicted values, the actual prestressing force loss is not significantly greater than that allowed for in the original design calculations for each tendon group. The LRA further states that as long as the trend lines do not fall below the MRV before the next scheduled surveillance, the tendon prestress force is acceptable; if not, an evaluation will be performed in accordance with 10 CFR 50.55a(b)(2)(viii)(B). The LRA states that trend lines based on new regression analyses of actual measured tendon forces for each tendon group (vertical and hoop) show that the group forces will not fall below the respective MRVs before the end of the period of extended operation for LSCS; however, because tendon force trends may vary with time, the regression analyses will be periodically updated after each surveillance. The LRA states that loss of containment tendon prestressing forces is a TLAA evaluated in accordance with 10 CFR 54.21(c)(1)(iii), and this program is credited for managing the aging effect 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 compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP X.S1. For the "acceptance criteria" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "acceptance criteria" program element of the GALL Report AMP includes a provision intended to address the case in which the trend line goes below the PLL when the comparison of the two lines is made. It was not clear whether the program enhancement (Commitment No. 44), that commits to a comparison of the trend line and the PLL and MRV, will also be applicable to, and implemented in, the "acceptance criteria" program element of the LRA AMP to establish consistency because (a) the LRA AMP and the program basis document state that enhancement to the LRA AMP is applicable only to the "monitoring and trending" program element and (b) during the audit, the staff noted that statements in the description of the "acceptance criteria" program element of the LRA program basis document appear to address the case in which the trend line goes below the PLL; however, the program element description also states that there is no enhancement to the program element. By letter dated June 19, 2015, the NRC staff issued RAI B.3.1.2-1, requesting that the applicant clarify whether the program enhancement (Commitment No. 44) in LRA Section B.3.1.2, which intended to establish consistency with the GALL Report AMP X.S1 and was described in the LRA AMP as applicable only to the "monitoring and trending" program element, will also be applicable to, and implemented in, the "acceptance criteria" program element to become consistent with the "acceptance criteria" program element of the GALL Report AMP. The applicant was also requested to provide conforming updates to the LRA and/or UFSAR supplement, as appropriate, based on the response.

In its response dated July 15, 2015, to RAI B.3.1.2-1, the applicant stated that the intent of the enhancement described in Commitment No. 44 is to establish consistency with the GALL Report AMP X.S1, and LRA Section B.3.1.2 is revised to indicate that the applicant has applied the enhancement and has implemented the "acceptance criteria" and "monitoring and trending" program elements to address the case in which the trend line goes below the PLL or MRV. The applicant also stated that the "monitoring and trending" program element enhanced by Commitment No. 44 requires the comparison of the trend line to the PLL and MRV for which acceptance criteria are implemented in the enhanced "acceptance criteria" program element, thereby making the "acceptance criteria" program element consistent with that in the GALL Report AMP. Accordingly, the applicant revised LRA Section B.3.1.2 and will revise appropriate section(s) of the program basis document to indicate that Commitment No. 44 is applicable and has been implemented in both the "monitoring and trending" and "acceptance criteria" program elements. The applicant also revised LRA Section A.3.1.2 to make the wording of Commitment No. 44 consistent with that in LRA Section B.3.1.2.

The staff noted that the "acceptance criteria" program element of the applicant's program basis document included acceptance criteria to address the case in which the trend line goes below the PLL or MRV. The staff finds the applicant's response acceptable because the applicant clarified that Commitment No. 44 is applicable and is also implemented in the "acceptance criteria" program element of the LRA AMP and that LRA Sections B.3.1.2 and A.3.1.2 are revised, thereby making the LRA AMP consistent with the GALL Report AMP. The staff's concern described in RAI B.3.1.2-1 is resolved.

The staff also reviewed the portions of the "monitoring and trending" and "acceptance criteria" 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 this enhancement follows.

Enhancement 1. LRA Section B.3.1.2, as revised by the applicant's response letter dated July 15, 2015, to RAI B.3.1.2-1, includes an enhancement to the "monitoring and trending" and "acceptance criteria" program element. In this enhancement (Commitment No. 44), the applicant committed to update the program before the period of extended operation to include the following activities: "For each surveillance interval, trending lines will be updated through the period of extended operation as part of the regression analysis and compared to the predicted lower limit and minimum required values for each tendon group." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP X.S1 and finds it acceptable because, when it is implemented, updated trend lines accounting for the latest set of measured forces will be compared to PLLs and MRVs following each surveillance, thus ensuring that appropriate corrective actions are taken if adverse trends are identified, including if the trend line crosses the PLL, which makes the LRA program elements consistent with the recommendations of the GALL Report AMP.

Based on its audit and review of the applicant's Concrete Containment Tendon Prestress program, as amended by letter dated July 15, 2015, in response to RAI B.3.1.2, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP X.S1. In addition, the staff reviewed the enhancement associated with the "monitoring and trending" and "acceptance criteria" program elements and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.3.1.2 summarizes operating experience related to the Concrete Containment Tendon Prestress program. The LRA states that review of the operating experience did not identify any adverse trend in program performance and that the inspection methods implemented by the program have been proven effective in detecting loss of containment tendon prestress. According to the LRA operating experience program element, the program provides appropriate guidance for evaluation, repair, or replacement for locations where degradation is found. Furthermore, the LRA states that assessments of the program are performed to identify the areas that need improvement to maintain the quality performance of the program, and the program is informed and enhanced, as necessary, through the systematic and ongoing review of both plant-specific and industry operating experience.

A summary description of examples of operating experience is provided below, indicating objective evidence that the Concrete Containment Tendon Prestress program will be effective in ensuring that intended functions will be maintained during the period of extended operation.

The LRA states that, in 2003 and 2008, LSCS performed the 25th-year interval ASME Code Section XI, Subsection IWL, examinations of the concrete containment tendons for LSCS, Units 1 and 2, respectively, which included testing to assess the loss of prestressing forces in select containment tendons for one unit in accordance with the IWL-2421 examination requirements for sites with multiple plants, consistent with ASME Code Section XI, Subsection IWL requirements. The LRA states that trend lines developed by regression analyses, in accordance with NRC IN 99-10, document the results of tendon prestress surveillance data through the 25th-year interval. The LRA further states that, in 2013, these analyses were revised to extend the trend lines for more than 60 years, the results of which demonstrated that the predicted prestress for tendons at LSCS, Units 1 and 2, will remain above the respective MRVs for the period of extended operation; therefore, monitoring of the containment tendon prestress forces to date indicates that the prestressing systems will continue to maintain their intended function through the period of extended operation without the need for tendon retensioning. The LRA states that, if subsequent continued updates to the regression analyses, proposed to be performed after each future surveillance, indicate that the predicted prestress forces for a tendon group are falling below the respective MRV, the condition would be entered into the corrective action program for evaluation and determination of appropriate corrective action. Therefore, the LRA concludes "there is sufficient confidence that implementation of the Concrete Containment Tendon Prestress [P]rogram will effectively identify degradation prior to failure or loss of intended function during the period of extended operation."

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. 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 evaluated and incorporated operating experience related to this program. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit and review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that implementation of the program has resulted in the applicant taking corrective actions. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP X.S1 was evaluated.

UFSAR Supplement. LRA Section A.3.1.2 provides the UFSAR supplement for the Concrete Containment Tendon Prestress program. The staff reviewed this UFSAR supplement description of the program, as amended by the applicant's letter dated July 15, 2015, and noted that it is consistent with the recommended description in SRP-LR Table 4.5-1. The staff also noted that the applicant committed (Commitment No. 44) to implement the enhancement to the program before the period of extended operation. The staff finds that the information in the UFSAR supplement, as amended by letter dated July 15, 2015, is an adequate summary description of the program.

Conclusion. On the basis of its audit and review of the applicant's Concrete Containment Tendon Prestress program, as amended by the applicant's letter dated July 15, 2015, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancement and confirmed that its implementation before the period of extended operation will make the AMP adequate to manage the applicable aging effects. 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 UFSAR 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:

- Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program
- Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping program

For these AMPs 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 section.

3.0.3.3.1 Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program

Summary of Technical Information in the Application. LRA Section B.2.2.1 describes the new Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program as a new plant-specific condition monitoring program that will manage the aging effect of loss of coating integrity in internally coated heat exchangers, piping, piping components, and tanks exposed to raw water, wastewater, and lubricating oil environments. The LRA states that the AMP manages this aging effect through periodic visual inspections. The LRA also states that the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program will be consistent with draft LR-ISG-2013-01, "Aging Management of Loss of Coating Integrity for Internal Service Level III (augmented) Coatings," issued for public comment on January 10, 2014, which included draft GALL Report AMP XI.M42, "Service Level III (augmented) Coatings Monitoring and Maintenance Program."

Staff Evaluation. The staff issued the final LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," on November 14, 2014, which included the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The staff reviewed program elements 1 through 7 of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3 and the final LR-ISG-2013-01 GALL Report AMP XI.M42. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these program elements follows.

Scope of Program. LRA Section B.2.2.1 states that all components within the scope of license renewal that are internally coated with Service Level III or Service Level III augmented coatings are within the scope of this program. This includes components in the essential service water, fire protection, nonessential service water, plant drainage, and RCIC systems that are exposed to raw water, wastewater, and lubricating oil.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which state that the scope of the program should include the specific SCs for which loss of coating integrity will be managed.

The staff noted that LRA Table 3.3.2-7, "Demineralized Water Makeup System," states that internally coated (i.e., galvanized steel) piping and piping components exposed to treated water will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. However, the "scope of program" program element does not include the demineralized water makeup system. Therefore, the staff did not have sufficient information to determine whether the "scope of program" element or LRA Table 3.3.2-7 is correct. By letter dated May 29, 2015, the staff issued RAI B.2.2.1-1, requesting that the applicant reconcile the “scope of program” program element and LRA Table 3.3.2-7.

In its response dated June 25, 2015, the applicant stated that LRA Table 3.3.2-7 is correct and that LRA Section B.2.2.1 was revised to include the demineralized water makeup system within the scope of the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. The applicant also revised the titles of the essential service water system and the nonessential service water system to essential cooling water system and nonessential cooling water system, respectively. Treated water was added as an applicable environment.

The staff finds the applicant’s response acceptable because the “scope of program” program element of the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program is consistent with the AMR items in the LRA Table 2’s. The staff’s concern described in RAI B.2.2.1-1 is resolved.

The staff finds the “scope of program” program element to be adequate because the applicant stated the specific components that will be managed by the program.

Based on its review of the application and review of the applicant’s response to RAI B.2.2.1-1, the staff confirmed that the “scope of program” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.2.1 states that the program is a condition monitoring program. The staff reviewed the applicant’s “preventive actions” program element against the criteria in SRP-LR Section A.1.2.3.2, which state that some condition monitoring programs do not rely on preventive actions; therefore, this information does not need to be presented.

The staff finds the applicant’s “preventive actions” program element to be adequate because it is consistent with GALL Report AMP XI.M42, which does not recommend any preventive actions.

Based on its review of the application, the staff confirmed that the “preventive actions” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.2.1 states that visual inspections are conducted to detect internal coatings that do not meet acceptance criteria and that physical testing is conducted to detect potential delamination. The visual inspections are used to detect peeling, delamination, blistering, cracking, flaking, chipping, rusting, and mechanical damage.

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 state that (a) the program should identify the aging effects that the program manages and should provide a link to the parameters that will be monitored and (b) the parameters monitored or inspected should be capable of detecting the presence and extent of aging effects.

The staff finds the “parameters monitored or inspected” program element to be adequate because the applicant has identified the aging effect (i.e., loss of coating integrity) and linked this to the specific inspection parameters that can be visually detected (e.g., delamination, cracking, and blistering).

Based on its review of the application, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.2.1 states that (a) baseline visual coating inspections will occur before the period of extended operation, (b) subsequent visual inspections will be based on an evaluation conducted by a coating specialist qualified by standards endorsed in RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," Revision 2, dated October 2010, of the effect of an internal coating failure on the in-scope component's intended function, potential problems identified during prior inspections, and known service life history, (c) inspection intervals will not exceed those recommended in draft GALL Report AMP XI.M42, Table 4a, "Inspection Intervals for Service Level III (Augmented) Coatings for Tanks, Piping, and Heat Exchangers," (d) the extent of inspections will be based on an evaluation of the effect of an internal coating failure on the in-scope component's intended function(s), potential problems identified during prior inspections, and known service life history, but not be less than all accessible surfaces for heat exchangers, strainers, and tanks and 73 1-ft axial length circumferential segments of piping or 50 percent of the length of each coating material and environment combination, (e) where inspection surfaces are limited due to geometry, the number of inspection segments of piping will be increased to cover an equivalent surface area, (f) a coating's environment consists of the environment inside the component and the material of the component, (g) inspection locations are based on susceptibility to degradation and consequences of failure, (h) coating surfaces between interlocking surfaces are not required to be inspected unless the joint has been disassembled to allow access for an internal coating inspection or other reasons, and (i) consideration will be given to the use of remote or robotic inspection tools when surfaces are not readily accessible for inspection. LRA Section B.2.2.1 also states that internal coating inspections may be omitted if the degradation of coatings cannot result in downstream effects; however, inspections are conducted if corrosion rates or inspection intervals have been based on the integrity of the coatings. In this case, as an alternative to direct internal visual inspection of the coatings, external wall thickness measurements can be performed to confirm the acceptability of the corrosion rate of the base metal. LRA Section B.2.2.1 further states that the training and qualification of individuals involved in coating inspections and evaluation of degraded conditions are conducted in accordance with standards endorsed in RG 1.54, including staff guidance.

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 state that the program should describe (a) how the program element will be capable of detecting the occurrence of age-related degradation before the loss of the CLB intended function(s) of in-scope components, (b) the when, where, and how data are collected, and (c) the basis of the sample size and location selection.

The staff noted that the final LR-ISG-2013-01 GALL Report AMP XI.M42 recommends a periodicity and size of inspection for alternative wall thickness measurements, which was not included in the draft LR-ISG-2013-01 GALL Report AMP XI.M42. Specifically, the AMP recommends that wall thickness measurements be conducted every 10 years, commencing 10 years before the period of extended operation. A representative sample size is 25 percent of accessible external surfaces for heat exchangers, strainers, and tanks; and 73 1-ft axial length circumferential segments for piping. In addition, the final GALL Report AMP XI.M42 recommends that the inspection grid size should be the same as that for flow-accelerated corrosion inspections. By letter dated May 29, 2015, the staff issued RAI B.2.2.1-2, requesting that the applicant state the periodicity and size of inspection for alternative wall thickness measurements.

In its response dated June 25, 2015, the applicant revised LRA Section B.2.2.1 to include the size and periodicity recommendations associated with external wall thickness measurements included in the final LR-ISG-2013-01. The applicant also revised LRA Section B.2.2.1 to include the following alternative recommendations included in the final LR-ISG-2013-01:

- incorporation of a reduced alternative inspection scope for piping when "documentation exists that manufacturer recommendations and industry consensus documents (i.e., those recommended in RG 1.54, or earlier versions of those standards) were complied with during installation"
- incorporation of a recommendation that "the lesser of 73 1-ft axial length circumferential segments of piping or 50 percent of the total length of each coating material and environment combination may be inspected"
- incorporation of a provision to conduct external wall thickness measurements in lieu of internal coating inspections if specific conditions are met related to the absence of downstream effects of coating failure, intended function(s) of the system, internal environment, potential for microbiologically-induced corrosion, potential for galvanic couples, and design credit for the coating

The staff finds the applicant's response and alternative recommendations acceptable because the changes are consistent with the final GALL Report AMP XI.M42. The staff's concern described in RAI B.2.2.1-2 is resolved.

The staff finds the applicant's "detection of aging effects" program element to be adequate because the program element describes the periodicity of inspections; explains how inspections will be conducted; and includes inspection location selection criteria, the sample size for inspections, and qualifications of individuals involved in coating inspections, consistent with the final GALL Report AMP XI.M42.

Based on its review of the application and review of the applicant's response to RAI B.2.2.1-2, the staff confirmed that the "detection of aging effects" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

<u>*Monitoring and Trending*</u>. LRA Section B.2.2.1 states that (a) a pre-inspection review of the previous two inspections and any repair activities of the component will be conducted, (b) trending of coating degradation results will be used to determine the next inspection interval, not to exceed the intervals in draft LR-ISG-2013-01 GALL Report AMP XI.M42, (c) a coatings specialist will prepare or review the inspection report, and (d) the report will include "a list and location of all areas evidencing deterioration, a prioritization of the repair areas into areas that must be repaired before returning the system to service, and areas where repair can be postponed to the next inspection." During the audit, the staff noted that a plant-specific procedure associated with coatings inspections requires that coating defects be photographed. LRA Section B.2.2.1 also states that, when base metal corrosion is the only issue related to loss of coating integrity and when wall thickness measurements are used in lieu of direct visual examination of the coating, the corrosion rate is trended. Coating defects are entered into the corrective action program.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which state that monitoring and trending activities should be described and that the results should be evaluated against the acceptance criteria to effect timely corrective or mitigative actions.

The staff finds the applicant's "monitoring and trending" program element to be adequate because (1) the applicant stated how it would conduct monitoring and trending (e.g., reviewing past inspection reports, involving coatings specialist in the post-inspection report, and providing details in the report), (2) coating defects are entered into the corrective action program where they will be evaluated against the acceptance criteria, and (3) they are consistent with the final GALL Report AMP XI.M42.

Based on its review of the application, the staff confirmed that the "monitoring and trending" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.2.1 states that coating defects are documented and evaluated in the corrective action program; the evaluation is conducted to ensure that the component's intended function(s) is met for all CLB design conditions; and "[a]s necessary, visual inspection may be supplemented by additional testing, such as adhesion testing or other inspection technique as determined by the inspector to accurately assess coating condition." LRA Section B.2.2.1 states that the acceptance criteria are as follows:

- Peeling and delamination is evaluated by a coatings specialist. Coating specialists are qualified in accordance with standards endorsed in RG 1.54. Physical testing is performed, where possible (i.e., sufficient room to perform the test), if it is required to assess the condition of the coating. Physical testing consists of measuring a minimum of three sample points adjacent to the defective area by destructive or nondestructive adhesion testing using ASTM International standards.
- Blisters are evaluated by a coatings specialist. If the blister is not repaired, the cause of the blister needs to be determined. "Physical testing is conducted if required to assess the condition of the coating." When coatings are credited for corrosion prevention, the base material in the vicinity of the blister is inspected to determine whether unanticipated corrosion has occurred.
- Cracking, flaking, and rusting are evaluated by a coatings specialist.
- Wall thickness measurements meet design minimum wall requirements.
- Engineering documents specific to the coating and substrate are used to determine whether adhesion testing results meet or exceed the acceptance criteria.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which state that the acceptance criteria of the program and its basis should be described and the acceptance criteria should ensure that the component's intended function(s) is met.

The staff noted the following:

- GALL Report AMP XI.M42 recommends that indications of peeling and delamination are not acceptable, whereas the applicant stated that a coatings specialist will evaluate the condition. The applicant did not state what criteria will be used to find peeling or delamination acceptable or what actions will be taken before returning the degraded component to service. The "corrective actions" program element of the final GALL Report AMP XI.M42 provides recommendations for evaluations and actions that will be taken before returning a component with peeling or delaminated coatings to service.

- The “corrective actions” program element in GALL Report AMP XI.M42 recommends that, for indications of peeling and delamination on components that will be returned to service without repair and for indications of blisters, adhesion testing be conducted. For blisters, alternatives to adhesion testing are permitted where adhesion testing is not possible due to physical constraints. The applicant stated that physical testing will be conducted, “if required.” The applicant did not state what criteria will be used to conclude that physical testing will not be required. Absent physical testing, it is not clear to the staff how the applicant will determine the extent of peeling, delamination, or blistering.

By letter dated May 29, 2015, the staff issued RAI B.2.2.1-3, requesting that the applicant state: (a) what criteria will be used to find peeling or delamination acceptable and what actions will be taken before returning the component with peeling or delaminated coatings to service and (b) what criteria will be used to conclude that physical testing will not be required when peeling, delamination, or blistering is detected and explain how it will determine the extent of the degraded coatings.

In its response dated June 25, 2015, the applicant revised the acceptance criteria in LRA Section B.2.2.1 to state that (a) peeling and delamination is not acceptable, (b) blisters are limited to “a few intact small blisters that are completely surrounded by sound coating bonded to the substrate,” and (c) the blister size and frequency is not increasing between inspections.

The staff finds the applicant’s response associated with the “acceptance criteria” program element acceptable because the revised acceptance criteria are consistent with those in the final GALL Report AMP XI.M42. The staff’s concern associated with the “acceptance criteria” program element described in RAI B.2.2.1-3 is resolved.

The staff finds the “acceptance criteria” program element to be adequate because the acceptance criteria related to observed parameters have been described and because they are consistent with the final GALL Report AMP XI.M42.

Based on its review of the application and review of the applicant’s response to RAI B.2.2.1-3, the staff confirmed that the “acceptance criteria” program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Corrective Actions. LRA Section B.2.2.1 states that inspection results that detect coatings that do not meet acceptance criteria will be entered in the corrective action program. LRA Section B.2.2.1 also states that “[i]f appropriate, corrective actions may include repair or replacement of the internal coating prior to the component being returned to service.”

The staff reviewed the applicant’s “corrective actions” program element against the criteria in SRP-LR Section A.1.2.3.7, which state that (a) if corrective actions permit analysis without repair or replacement, the analysis should ensure that the component’s intended function(s) is maintained consistent with the CLB and (b) actions to be taken when the acceptance criteria are not met should be described in appropriate detail or referenced to source documents.

The staff noted that the “corrective actions” program element of GALL Report AMP XI.M42 states that coatings that do not meet acceptance criteria are repaired, replaced, or removed. The staff concludes that the applicant’s statement, “if appropriate,” implies that coatings that do not meet acceptance criteria could be returned to service without repair, replacement, or removal. The applicant did not state what criteria will be used to return coatings that do not meet acceptance criteria to service without repair. By letter dated May 29, 2015, the staff issued RAI B.2.2.1-3, requesting that the applicant state what criteria will be used to return components with coatings that do not meet acceptance criteria to service without repair, replacement, or removal of the coatings.

In its response dated June 25, 2015, the applicant revised LRA Section B.2.2.1 to state that "[c]oatings that do not meet acceptance criteria are repaired, replaced, or removed. Testing or examination is conducted to ensure that the extent of repaired or replaced coatings encompasses sound coating material." The applicant also revised the program to include corrective actions associated with (a) returning components with coatings exhibiting peeling or delamination to service, (b) conducting confirmatory wall thickness measurements when the base metal has been exposed or when the base metal is located below a blister, and (c) testing for blisters that are not repaired.

The staff noted that the applicant's changes to its program included all of the recommendations associated with the additional corrective action provisions in GALL Report AMP XI.M42. The staff finds the applicant's response and additional corrective actions associated with the "corrective actions" program element acceptable because they are consistent with the final GALL Report AMP XI.M42. The staff's concern associated with the "corrective actions" program element described in RAI B.2.2.1-3 is resolved.

Based on its review of the application and review of the applicant's response to RAI B.2.2.1-3, the staff confirmed that the "corrective action" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.7; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.2.1 summarizes operating experience related to the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. The applicant stated that in March 2007, during the inspection of internal coatings on diesel generator cooling water heat exchanger end bells, the CeramAlloy^{TM} coating came loose from the base material in some of the end bells. Tube blockage had occurred in one instance. The applicant determined that the likely cause was inappropriate surface preparation during installation of the coating. Corrective measures were implemented and delamination of this coating has not subsequently occurred on these heat exchangers. In January 2014 peeling, flaking and erosion were detected in the CeramAlloy^{TM} coating on a reactor building closed cooling water heat exchanger. The areas exhibiting flaking and peeling were repaired, the thinning area was evaluated, and repair was deferred until 2017. In September 2012 the CeramAlloy^{TM} coatings on the primary containment chiller condensers exhibited erosion and thinning. This degradation was typically found in the middle of the dollar plate of the heat exchanger. Spare end covers were procured and were coated before the conduct of maintenance activities on these heat exchangers.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which state that the applicant should review relevant plant-specific or generic industry operating experience applicable to the new program.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its review of the application, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience and that the program, when implemented, can adequately manage the effects of aging on SSCs within the scope of the program.

UFSAR Supplement. As amended by letter dated June 25, 2015, LRA Section A.2.2.1 provides the UFSAR supplement for the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the new Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program before the period of extended operation with baseline inspections commencing in the 10-year period before the period of extended operation for managing the effects of aging for applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its technical review of the applicant's Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance 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 UFSAR 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 Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program

Summary of Technical Information in the Application. By letter dated August 6, 2015, the applicant revised the LRA and provided LRA Section B.2.2.2, which describes the applicant's Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program, as a new plant-specific condition monitoring program that will manage the aging effects of cracking in ASME Code Class 1 small-bore piping. The applicant stated that the program will perform inspections of a sample of ASME Code Class 1 small-bore piping less than NPS 4-inches and greater than or equal to NPS 1-inch. The applicant also stated that the program will perform inspections before and during the period of extended operation, which will augment the requirements of ASME Code, Section XI, Inservice Inspections. The applicant further stated that the scope of the program will include pipes, fittings, branch connections, and full penetration (butt) welds and partial penetration (socket) welds. LSCS, Unit 1, will implement a Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program. The staff's review of the applicant's Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping program is discussed in SER Section 3.0.3.1.11.

Staff Evaluation. The staff reviewed program elements 1 through 6 of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these program elements is discussed below. The staff's review of the "corrective actions," "confirmation process," and "administrative controls" programs elements are documented in SER Section 3.0.4.

Scope of Program. LRA Section B.2.2.2 states that the scope of the program includes ASME Code Class 1 piping less than NPS 4-inches and greater than or equal to NPS 1-inch. The scope includes reactor pressure boundary pipes, fittings, branch connections, and full penetration (butt) and partial penetration (socket) welds.

The staff reviewed the applicant's "scope of program" program element against the criterion in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific structures and components that will be managed.

The staff finds the applicant's "scope of program" program element to be adequate because the scope of the ASME Code Class 1 small-bore in-scope piping has been identified.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "scope of program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1; therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.2.2.2 states that the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping program is a condition monitoring program and uses inspections to detect degradation of components before loss of intended function. The applicant stated that the program does not include preventive actions; however, it validates the effectiveness of the Water Chemistry AMP to mitigate SCC and the adequacy of the design of the ASME Code Class 1 small-bore piping.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which state that some condition monitoring programs do not rely on preventive actions; therefore, this information does not need to be presented.

The staff finds the applicant's "preventive actions" program element to be adequate because this program is a condition monitoring program that does not rely on preventive actions.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "preventive actions" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.2 for condition monitoring programs; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.2.2.2 states that the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program includes inspection activities that can detect cracking that may be caused by SCC, cyclical thermal and mechanical fatigue, and thermal stratification or thermal turbulence. The LRA also states that inspections will be performed by examinations, which have been demonstrated capable of detecting cracking.

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 state that, for a condition monitoring program, the parameters monitored or inspected should be capable of detecting the presence and extent of the aging effect, such as detection of cracks.

The staff finds the applicant's "parameters monitored or inspected" program element to be adequate because this program is a condition monitoring program that will use volumetric examination techniques that have been demonstrated to be capable of detecting cracking, or destructive examination.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3 for condition monitoring programs; therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.2.2.2 states that the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program will augment ASME Section XI, Inservice Inspection requirements and will detect cracking through the use of volumetric or destructive examinations. The applicant stated that the inspection of butt welds associated with this program will be performed using volumetric examinations as specified by ASME Code, Section XI. The applicant also stated that socket welds will be inspected using demonstrated volumetric examination techniques that can detect cracking, or by means of destructive examinations. The applicant further stated that, because destructive examinations are capable of detecting cracking and have the potential to yield more information than volumetric examinations, such as identifying the root cause, each destructive examination can be credited as having volumetrically examined two socket welds.

The program states that LSCS, Unit 2, which has operated for 31 years, experienced a failure of a socket weld in 2005 that was determined to be the result of age-related degradation. An evaluation was performed to identify similar small-bore piping that may be susceptible to the same causal factors that contributed to the failure. The applicant stated that, as a result of these evaluations, it identified a population of 10 socket welds in the Unit 2 small-bore population that can be associated with the same causal factors that contributed to the failure identified in 2005. The applicant also stated that the identified population of socket welds will be subjected to periodic inspections. These inspections would be completed during the 6 years before the period of extended operation and would be repeated every 10 years during the period of extended operation. The sample size for these inspections would be 50 percent of the susceptible population (five welds).

The program also includes a one-time inspection using volumetric or destructive examinations for ASME Code Class 1 small-bore piping welds determined not to be susceptible to the causal factors associated with the failure identified in 2005. The applicant stated that the one-time inspection would be completed during the 6 years before the period of extended operation and will include at least 3 percent of the weld population or a maximum of 10 welds for each weld type. Based on the total population of in-scope small-bore piping welds, the one-time inspection would consist of 10 socket welds and 3 butt welds. The applicant also stated that, if additional ASME Class 1 small-bore welds fail, or degradation, or age-related cracking is identified by the these examinations (one-time or periodic), additional evaluations would be performed as part of the corrective action program to determine the need for further periodic inspections.

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 state that detection of aging effects should occur before there is a loss of structure or loss of component intended function(s). Therefore, the "detection of aging effects" program element should describe (a) how the program element will be capable of detecting the occurrence of age-related degradation before the loss of the CLB intended function(s) of in-scope components, (b) when, where, and how data are collected, (c) the basis for sample size and location selection based on susceptibility or previous failure history, and (d) bias toward locations most susceptible to the specific aging effect.

The staff noted that the applicant's plant-specific program incorporates two specific inspection programs, a periodic program for socket welds that may be susceptible to the 2005 failure and a one-time program for the balance of the ASME Code Class 1 small-bore piping, which includes butt welds and socket welds. As part of the periodic program, five socket welds will be examined before the period of extended operation. These examinations will be repeated for each subsequent 10-year interval during the period of extended operation. In addition, 10 socket and 3 butt welds will be examined before the period of extended operation as part of the one-time inspection. Based on the total number of proposed inspections (periodic and one-time inspections), and because the inspections would be biased toward selection of the most susceptible locations, it is believed that potential aging degradation of ASME Code Class 1 small-bore piping will be detected before loss of intended function(s).

The staff finds the applicant's "detection of aging effects" program element to be adequate because the applicant will be performing a combination of one-time and periodic inspections to identify age-related degradation before and during the period of extended operation. In addition, the type of inspections, inspection intervals, extent of inspections, and sample size are considered adequate for managing cracking of ASME Code Class 1 small-bore piping welds during the period of extended operation.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "detection of aging" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4; therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.2.2.2 states that the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program will include inspection activities to detect cracking due to SCC, cyclical thermal and mechanical fatigue, and thermal stratification or thermal turbulence. The applicant stated that the program does not have specific actions that would be applied to monitoring and trending the rate of age-related degradation. The program will use the applicable requirements of ASME Code, Section XI, when age-related degradation or cracking is identified, to determine acceptability of the condition and the required corrective actions. The applicant also stated that it will use plant-specific operating experience relative to the condition of the small-bore piping resulting from the periodic inspections to determine whether the sample population of the periodic inspection should be increased. The applicant further stated that the results of the one-time inspection will also be used to determine whether additional welds should be periodically examined.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which state that monitoring and trending activities should be described and the results should be evaluated against the acceptance criteria to effect timely corrective or mitigative actions. Plant-specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency.

The staff finds the applicant's "monitoring and trending" program element to be adequate because the program will use the acceptance criteria of ASME Code, Section XI, and when indications of degradation or cracking are identified, the adverse conditions would be entered in the corrective action program. In addition, the program's inspection results, along with industry and plant-specific operating experience, will be used to evaluate the frequency of inspections.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "monitoring and trending" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.5; therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.2.2.2 states that the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program will use the acceptance criteria of ASME Code Section XI, Subsection IWA-3000, which is applicable to ASME Code Class 1 components.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which state, in part, that it is not necessary to justify any acceptance criteria that are taken from codes and standards incorporated by reference into NRC regulations because these have been subject to prior NRC review process and have been approved or endorsed for use. The staff noted that the small-bore piping referenced in the program consists of ASME Code Class 1 piping; therefore, the use of the acceptance criteria of ASME Code, Section XI, Subsection IWA-3000, is applicable and appropriate.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff confirmed that the "acceptance criteria" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6; therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.2.2.2 summarizes operating experience related to the applicant's program. The LRA states that the applicant performed an extensive review of plant operating experience to determine whether LSCS, Unit 2, experienced any cracking of ASME Code Class 1 small-bore piping due to fatigue or SCC. The applicant stated that this included review of the corrective action program database going back to January 2001, as well as review of correspondence to the NRC going back to 1982, and included interviews with the LSCS ASME Inservice Inspection program owner. The applicant also stated that these reviews identified a leak detected by VT-2 inspection of the reactor coolant pressure boundary in 2005. The applicant further stated that the leak was located on a socket weld on a 2-inch main steam drain line. The cause of the failure was attributed to a defective weld repair performed in 1995. The applicant stated that the root cause evaluation performed in 2005 concluded that the failure was the result of a defective weld repair performed in 1995; however, it is now considered that age-related degradation also contributed to the failure.

The applicant stated that since 2003, it has performed periodic volumetric examinations of ASME Code Class 1 small-bore piping butt welds and visual examinations of socket welds. The applicant also stated that, before 2002, ASME Code Class 1 small-bore piping butt and socket welds were periodically examined by visual examinations and that, with the exception of the failure of the socket weld in 2005, there were no other examples of unacceptable conditions. The applicant further stated that the program will be informed and enhanced as needed through the ongoing review of plant-specific and industry operating experience.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which state, in part, that currently available operating experience applicable to the new program, as well as consideration of future plant-specific and industry operating experience related to AMPs, should be discussed. SRP-LR Section A.1.2.3.10 also states that the information on the operating experience should provide objective evidence to support that the program adequately manages the effects of aging during the period of extended operation.

During its review, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its review of the application, as amended by letter dated August 6, 2015, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10; therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.2.2.2, dated August 6, 2015, provides the UFSAR supplement for the Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program at LSCS, Unit 2. The staff reviewed this UFSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff also noted that the applicant committed to implement the new Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program before the period of extended operation for managing the effects of aging of applicable components. The staff finds that the information in the UFSAR supplement is an adequate summary description of the program.

Conclusion. On the basis of its technical review of the applicant's Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program at LSCS, Unit 2, 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 UFSAR 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 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in the Application

In LRA Appendix A, "Updated Final Safety Analysis Report Supplement," Section A.1.5, "Quality Assurance Program and Administrative Controls," and Appendix B, "Aging Management Programs," Section B.1.3, "Quality Assurance Program and Administrative Controls," the applicant described the elements of corrective action, confirmation process, and administrative controls that are applied to the AMPs for both safety-related and nonsafety-related components.

LRA Appendix A, Section A.1.5, states the following:

> The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, "Quality Assurance For Aging Management Programs (Branch Technical Position IQMB-1)," of NUREG–1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and nonsafety-related systems, structures, and components (SSCs) that are subject to Aging Management Review (AMR).

LRA Appendix B, Section B.1.3, states the following:

> The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)," of NUREG–1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and nonsafety-related systems, structures, components (SSCs), and commodity groups that are subject to AMR.

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, Branch Technical Position RLSB-1, "Aging Management Review – Generic," (SRP-LR BTP RLSB-1) describes 10 attributes of an acceptable AMP. Three of these 10 attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. SRP-LR BTP RLSB-1 Table A.1-1 provides the following description of these quality assurance attributes:

- Element No. 7 - Corrective Actions, including root cause determination and prevention of recurrence, should be timely;
- Element No. 8 - Confirmation Process, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective; and,
- Element No. 9 - Administrative Controls, which should provide a formal review and approval process.

SRP-LR, Branch Technical Position IQMB-1, "Quality Assurance for Aging Management Programs," (SRP-LR BTP IQMB-1) states that those aspects of the AMP 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'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. SRP-LR 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 LRA Appendix A, Section A.1.5, and Appendix B, Section B.1.3, which describe how the applicant's existing quality assurance program includes the QA-related elements (corrective action, confirmation process, and administrative controls) for AMPs consistent with the staff's guidance described in SRP-LR BTP IQMB-1. The staff also reviewed a sample of AMP program basis documents and verified that the AMPs implement the corrective action program, confirmation processes, and administrative controls as described in the LRA. Based on its review, the staff determined that the quality assurance attributes presented in the AMP program basis documents and the associated AMPs 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 applicant's AMPs and their associated quality assurance attributes provided in LRA Appendix A, Section A.1.5, and Appendix B, Section B.1.3, are consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.0.5 Operating Experience for Aging Management Programs

3.0.5.1 Summary of Technical Information

LRA Section B.1.4, "Operating Experience," describes the consideration of operating experience for AMPs. The LRA states that operating experience for the programs credited with managing the effects of aging are reviewed and also included a review of corrective actions that resulted in program enhancements.

In accordance with the Exelon fleet Exelon Operating Experience (OPEX) program, which conforms to the recommendations of LR-ISG-2011-05, "Ongoing Review of Operating Experience," dated March 16, 2012, the applicant states that it performs a systematic review of plant-specific and industry operating experience concerning aging management and age-related degradation to ensure that the license renewal AMPs will be effective in managing the aging effects for which they are credited.

3.0.5.2 Staff Evaluation

3.0.5.2.1 Overview

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 in a way consistent with the CLB for the period of extended operation. SRP-LR Appendix A describes 10 elements of an acceptable AMP. SRP-LR Section A.1.2.3.10 describes program element 10, "operating experience." On March 16, 2012, the staff issued final LR-ISG-2011-05, "Ongoing Review of Operating Experience," which includes interim revisions to the SRP-LR to clarify criteria for the operating experience program element.

The following evaluation covers the staff's review of the first criterion, which concerns the consideration of future operating experience.

3.0.5.2.2 Consideration of Future Operating Experience

The staff reviewed LRA Sections B.1.4, "Operating Experience," and B.2, "Aging Management Programs," to determine how the applicant will use future operating experience to ensure that the AMPs are effective. The staff evaluated the applicant's operating experience review activities, as described in the LRA. The staff's evaluations with respect to these SRP-LR sections follow in SER Sections 3.0.5.2.3 and 3.0.5.2.4, respectively.

3.0.5.2.3 Acceptability of Existing Programs

SRP-LR Section A.4.2 describes existing programs generally acceptable to the staff for the capture, processing, and evaluation of operating experience concerning age-related degradation and aging management during the term of a renewed operating license. The acceptable programs are those relied on to meet the requirements of 10 CFR Part 50 Appendix B and item I.C.5, "Procedures for Feedback of Operating Experience to Plant Staff," in NUREG-0737, "Clarification of TMI Action Plan Requirements," dated November 1980. SRP-LR Section A.4.2 also states that, as part of meeting the requirements of NUREG–0737, item I.C.5, the applicant's operating experience program should rely on active participation in the INPO operating experience program (formerly the INPO Significant Event Evaluation and

Information Network (SEE-IN) program endorsed in NRC GL 82-04, "Use of INPO SEE-IN Program," dated March 9, 1982).

LRA Section B.1.4 states that the applicant uses its Operating Experience program to systematically capture and review operating experience from plant-specific and industry sources. The applicant stated that the Operating Experience program meets the requirements of NUREG-0737. The applicant further states that the Operating Experience program interfaces and relies on active participation in the INPO operating experience program.

Based on this information, the staff determined that the applicant's Operating Experience program is consistent with the programs described in SRP-LR Section A.4.2.

3.0.5.2.4 Areas of Further Review

Application of Existing Programs and Procedures to the Processing of Operating Experience Related to Aging. SRP-LR Section A.4.2 states that the programs and procedures relied on to meet the requirements of 10 CFR Part 50 Appendix B and NUREG-0737, item I.C.5, should not preclude the consideration of operating experience on age-related degradation and aging management. The applicant stated that operating experience from plant-specific and industry sources are systematically captured and reviewed on an ongoing basis in accordance with the Quality Assurance program, which is consistent with 10 CFR Part 50 Appendix B, and the INPO operating experience program, which is consistent with NUREG-0737, item I.C.5.

LRA Section B.1.4 states that the ongoing evaluation of operating experience included a review of corrective actions resulting in plant program enhancements helping to prevent events that have occurred at other plants. The LRA states that the operating experience in each AMP summary identifies past corrective actions that have resulted in program enhancements and provides objective evidence that the effects of aging have been, and will continue to be, adequately managed so that the intended functions of the SCs within the scope of each program will be maintained during the period of extended operation.

Based on this information, the staff determined that the processes implemented under the Quality Assurance program, the corrective action program, and the enhanced Operating Experience program would not preclude consideration of age-related operating experience, which is consistent with the guidance in SRP-LR Section A.4.2. In addition, SRP-LR Section A.4.2 states that the applicant should use the option described in SRP-LR Appendix A.2 to expand the scope of the 10 CFR Part 50 Appendix B program to include nonsafety-related SCs. In addition, LRA Section B.1.3 states that the applicant's Quality Assurance Program includes nonsafety-related SCs, which the staff finds consistent with the guidance in SRP-LR Section A.2, and is, therefore, consistent with SRP-LR Section A.4.2 as well. SER Section 3.0.4 documents the staff's evaluation of LRA Section B.1.3.

Consideration of Guidance Documents as Industry Operating Experience. SRP-LR Section A.4.2 states that NRC and industry guidance documents and standards applicable to aging management, including revisions to the GALL Report, should be considered as sources of industry operating experience and evaluated accordingly.

LRA Section B.1.4 states that the sources of external operating experience include INPO documents; NRC documents and other documents, such as licensee event reports and 10 CFR Part 21, "Reporting of Defects and Noncompliance," reports; and the OPEX process, which interfaces with, and relies on, active participation in the INPO operating experience program. The applicant also listed additional external sources that include LR-ISGs and GALL Report revisions.

The staff finds the sources of industry operating experience acceptable because the applicant will consider an appropriate breadth of industry operating experience for impacts to its aging management activities, which includes sources that the staff considers to be the primary sources of external operating experience information. The applicant's consideration of industry guidance documents as operating experience is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Screening of Incoming Operating Experience. SRP-LR Section A.4.2 states that all incoming plant-specific and industry operating experience should be screened to determine whether it involves age-related degradation or impacts to aging management activities. LRA Section B.1.4 states that the LSCS personnel receive and review operating experience (internal and external to Exelon) on a daily basis. The applicant has an OPEX process that interfaces with, and relies on, active participation in the INPO operating experience program. The applicant states that the OPEX process includes screening, evaluation, and acting on operating experience documents and information to prevent or mitigate the consequences of similar events. The applicant also states that the OPEX process includes review of operating experience from external and internal sources.

LRA Section A.1.6, "Operating Experience," states that the Operating Experience program conforms to the recommendations of LR-ISG-2011-05, "Ongoing Review of Operating Experience." In accordance with this program, all incoming operating experience items are screened to determine whether they may involve age-related degradation or aging management impacts. Items so identified are further evaluated, and the AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

The staff finds the applicant's operating experience review processes acceptable because these processes include screening of all new operating experience to identify and evaluate items that have the potential to impact the aging management activities. The applicant's screening of plant-specific and industry operating experience is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Identification of Operating Experience Related to Aging. SRP-LR Section A.4.2 states that coding should be used within the plant corrective action program to identify operating experience involving age-related degradation applicable to the plant. The SRP-LR also states that the associated entries should be periodically reviewed and that any adverse trends should receive further evaluation.

The applicant's screening and evaluation of a potential aging issues procedure provides guidance to perform an ongoing review of internal and external operating experience to identify areas where AMPs credited during license renewal process should be informed, updated, and enhanced when necessary or where new AMPs should be developed so that the intended functions of the structures and passive components are maintained. The applicant also states that NRC ISG and the new GALL Report recommendations are evaluated and incorporated if applicable, and, as part of the periodic UFSAR update in accordance with 10 CFR 54.37(b), their site engineering will determine whether there are any newly identified SSCs that require aging management.

The staff finds the applicant's identification of operating experience related to aging acceptable because the applicant has a means at a programmatic level to identify, trend, and evaluate operating experience that involves age-related degradation. The applicant's identification of age-related operating experience applicable to the plants is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Information Considered in Operating Experience Evaluations. SRP-LR Section A.4.2 states that operating experience identified as involving aging should receive further evaluation based on consideration of information, such as the affected SSCs, materials, environments, aging effects, aging mechanisms, and AMPs. The SRP-LR also states that actions should be initiated within the corrective action program to either enhance the AMPs or develop and implement new AMPs if it is found through an operating experience evaluation that the effects of aging may not be adequately managed.

LRA Section B.1.4 states that operating experience is used at LSCS to enhance plant programs, prevent repeat events, and prevent events that have occurred at other plants. In addition, as part of the Exelon fleet, LSCS personnel receive operating experience (internal and external to Exelon) daily. The LRA also states that the OPEX process includes screening, evaluation, and acting on operating experience documents and information to prevent or mitigate the consequences of similar events, including review of operating experience from external and internal sources and external operating experience from INPO and the NRC. Internal operating experience includes event investigations, trending reports, and lessons learned from in-house events as captured in program health reports, program assessments, and the corrective action program.

The staff determined that the applicant's evaluations of age-related operating experience will include the assessment of appropriate information to determine potential impacts to the aging management activities. The staff also determined that the applicant's Operating Experience program, in conjunction with the corrective action program, will implement any changes necessary to manage the effects of aging, as determined through its operating experience evaluations. Therefore, the staff finds that the information considered in the applicant's operating experience evaluations and use of the Operating Experience program and corrective action program to ensure that the effects of aging are adequately managed is consistent with the guidance in SRP-LR Section A.4.2.

Evaluation of AMP Implementation Results. SRP-LR Section A.4.2 states that the results of implementing the AMPs, such as data from inspections, tests, and analyses, should be evaluated regardless of whether the acceptance criteria of the particular AMP have been met. SRP-LR Section A.4.2 states that this information should be used to determine whether it is necessary to adjust the inspection activities for aging management. In addition, SRP-LR Section A.4.2 states that actions should be initiated within the plant corrective action program to either enhance the AMPs or develop and implement new AMPs if these evaluations indicate that the effects of aging may not be adequately managed.

LRA Section A.1.6 states that the Exelon fleet OPEX program that is implemented at LSCS conforms to the recommendations of LR-ISG-2011-05, "Ongoing Review of Operating Experience." In accordance with this program, all incoming operating experience items are screened to determine whether they may involve age-related degradation or aging management impacts. Items so identified are further evaluated, and the AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined through these evaluations that the effects of aging may not be adequately managed.

The staff reviewed the LRA and finds the applicant's treatment of AMP implementation results as operating experience acceptable because the applicant will evaluate these results and use the information to determine whether to adjust the aging management activities. The applicant's activities for the evaluation of AMP implementation results are, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Training. SRP-LR Section A.4.2 states that training on age-related degradation and aging management should be provided to those personnel responsible for implementing the AMPs and those personnel that may submit, screen, assign, evaluate, or otherwise process plant-specific and industry operating experience. SRP-LR Section A.4.2 also states that the training should be periodic and include provisions to accommodate the turnover of plant personnel.

LRA Section A.1.6 states that the Operating Experience program procedures include training for personnel responsible for submitting, screening, assigning, evaluating, or otherwise processing plant-specific and industry operating experience concerning age-related degradation and aging management and training for personnel responsible for implementing AMPs based on the complexity of the job performance requirements and assigned responsibilities.

The staff reviewed the LRA and operating experience procedure showing that periodic training is provided to personnel who have direct responsibility for AMP effectiveness or who provide a supporting role in the process, and it determined that the scope of personnel included in the applicant's training program are consistent with the guidelines in SRP-LR Section A.4.2. The staff also determined that the applicant has demonstrated that its training program covers age-related degradation and aging management topics and that its ongoing actions of training and ongoing review of OPEX are in place. The staff finds the applicant's OPEX training activities are, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Reporting Operating Experience to the Industry. SRP-LR Section A.4.2 states that guidelines should be established for reporting plant-specific operating experience on age-related degradation and aging management to the industry. The staff finds the applicant's reporting of its plant-specific operating experience, associated with aging management and age-related degradation, to the industry in accordance with the guidelines established in its program to be acceptable because the applicant has established appropriate expectations and guidelines for identifying plant-specific operating experience concerning aging management and age-related degradation to the industry. The applicant's establishment of these guidelines is, therefore, consistent with the guidance in SRP-LR Section A.4.2.

Schedule for Implementing the Operating Experience Review Activities. SRP-LR Section A.4.2 states that the operating experience review activities should be implemented no later than the date on which the renewed license is issued; these activities should then be implemented on an ongoing basis throughout the term of a renewed license.

LRA Section B.1.4 states that the Operating Experience program will be implemented on an ongoing basis throughout the terms of the renewed licenses. In addition, LRA Section A.1.6 provides the UFSAR supplement summary description of the applicant's programmatic activities for ongoing review of the operating experience. On issuance of the renewed licenses, this summary description will be incorporated into each plant's CLB. At that time, the applicant will be obligated to conduct its operating experience review activities accordingly.

The staff finds the implementation schedule acceptable because the applicant will implement the operating experience review activities on an ongoing basis throughout the term of the renewed operating licenses.

3.0.5.2.5 Summary

Based on its review of the LRA, the staff determined that the applicant's programmatic activities for the ongoing review of operating experience are acceptable for (a) the systematic review of plant-specific and industry operating experience to ensure that the license renewal AMPs are, and will continue to be, effective in managing the aging effects for which they are credited and (b) the enhancement of AMPs or development of new AMPs when it is determined through the evaluation of operating experience that the effects of aging may not be adequately managed. Based on the completion of the staff's review and the consistency of the applicant's operating experience review activities with the guidance in LR-ISG-2011-05, the staff finds the applicant's programmatic activities for the ongoing review of operating experience acceptable.

3.0.5.3 UFSAR Supplement

In accordance with 10 CFR 54.21(d), the UFSAR supplement must contain a summary description of the programs and activities for managing the effects of aging. LRA Section A.1.6 provides the UFSAR supplement summary description of the applicant's programmatic activities for the ongoing review of operating experience.

The staff reviewed LRA Section A.1.6 and found that the summary description of the ongoing evaluation of operating experience related to aging management states that LSCS will consider age-related degradation or aging management impacts.

SRP-LR Section A.4.2, as established in LR-ISG-2011-05, states that the programmatic activities for the ongoing review of plant-specific and industry operating experience concerning age-related degradation and aging management should be described in the UFSAR supplement. LR-ISG-2011-05 also revises SRP-LR Table 3.0-1 to include example summary description language for the UFSAR supplement. The staff reviewed the content of LRA Section A.1.6 against the example language in SRP-LR Table 3.0-1. Based on its review, the staff determined that the content of the applicant's summary description is consistent with the example and also sufficiently comprehensive to describe the applicant's programmatic activities for evaluating operating experience to maintain the effectiveness of the AMPs. Therefore, the staff finds the applicant's UFSAR supplement summary description acceptable.

3.0.5.4 Conclusion

Based on its review of the applicant's programmatic activities for the ongoing review of operating experience, the staff concludes that the applicant has demonstrated that operating experience will be reviewed to ensure that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for these activities and concludes that it provides an adequate summary description, as required by 10 CFR 54.21(d).

3.1 Aging Management of Reactor Vessel, Internals and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the Reactor Vessel, Internals, and Reactor Coolant System components and component groups of the following:

- Reactor Coolant Pressure Boundary System
- Reactor Vessel
- Reactor Vessel Internals

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the Reactor Vessel, Internals, and Reactor Coolant System components and component groups. LRA Table 3.1.1, "Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the Reactor Vessel, Internals, and Reactor Coolant 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.

3.1.2 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, Internals, and Reactor Coolant 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 the applicant's AMRs to verify its claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.1-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or that require no aging management are noted in Table 3.1-1 and discussed in SER Section 3.1.2.1.1. Details of the staff's evaluation of AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information, are documented in SER Sections 3.1.2.1.2 through 3.1.2.1.4.

During its review, 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 of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with or are 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 of AMRs that are not consistent with or are not addressed in the GALL Report are documented in SER Section 3.1.2.3.

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, Internals and Reactor Coolant System Components in the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High strength, low-alloy steel top head closure stud assembly exposed to air with potential for reactor coolant leakage (3.1.1-1)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Nickel alloy tubes and sleeves exposed to reactor coolant and secondary feedwater/steam (3.1.1-2)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.1)
Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux (3.1.1-3)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel pressure vessel support skirt and attachment welds (3.1.1-4)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, or steel (with stainless steel or nickel alloy cladding) steam generator components, pressurizer relief tank components or piping components or bolting (3.1.1-5)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant (3.1.1-6)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant (3.1.1-7)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy steam generator components exposed to reactor coolant (3.1.1-8)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy RCPB piping; flanges; nozzles & safe ends; pressurizer shell heads & welds; heater sheaths & sleeves; penetrations; thermal sleeves exposed to reactor coolant (3.1.1-9)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.1)
Steel (with or without nickel-alloy or stainless steel cladding), stainless steel; nickel alloy reactor vessel flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant (3.1.1-10)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation, and for Class 1 components environmental effects on fatigue are to be addressed (see SRP, Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.1)
Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles (3.1.1-11)	Cumulative fatigue damage due to fatigue	Fatigue is a TLAA evaluated for the period of extended operation; check ASME Code limits for allowable cycles (less than 7,000 cycles) of thermal stress range (see SRP Section 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel steam generator components: upper and lower shells, transition cone; new transition cone closure weld exposed to secondary feedwater or steam (3.1.1-12)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and, for Westinghouse Model 44 and 51 S/G, if corrosion of the shell is found, additional inspection procedures are developed	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.2)
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux (3.1.1-13)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA is to be evaluated in accordance with Appendix G of 10 CFR Part 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.1.2.2.3)
Steel (with or without cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-14)	Loss of fracture toughness due to neutron irradiation embrittlement	Chapter XI.M31, "Reactor Vessel Surveillance"	Yes	Reactor Vessel Surveillance An exception applies to the Reactor Vessel Surveillance program	Consistent with the GALL Report (see SER Section 3.1.2.2.3)
Stainless steel Babcock & Wilcox (including CASS, martensitic SS, and PH SS) and nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux (3.1.1-15)	Reduction of ductility and fracture toughness due to neutron irradiation embrittlement, and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement	Ductility - Reduction in fracture toughness is a TLAA to be evaluated for the period of extended operation, see the SRP, Section 4.7, "Other Plant-Specific TLAAs," for acceptable methods of meeting the requirements of 10 CFR 54.21(c).	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.3)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel alloy top head enclosure vessel flange leak detection line (3.1.1-16)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.2.4)
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-17)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry” for BWR water, and a plant-specific verification program	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.2.4)
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process exposed to reactor coolant (3.1.1-18)	Crack growth due to cyclic loading	Growth of intergranular separations is a TLAA evaluated for the period of extended operation. The Standard Review Plan, Section 4.7, “Other Plant-Specific Time-Limited Aging Analysis,” provides guidance for meeting the requirements of 10 CFR 54.21(c))	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.5)
Stainless steel reactor vessel closure head flange leak-detection line and bottom-mounted instrument guide tubes (external to reactor vessel) (3.1.1-19)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.6)
Cast austenitic stainless steel Class 1 piping, piping components, and piping elements exposed to reactor coolant (3.1.1-20)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry” and, for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific aging management program	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.6)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-21)	Cracking due to cyclic loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components. The ISI program is to be augmented by a plant-specific verification program	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.2.7)
Steel steam generator feedwater impingement plate and support exposed to secondary feedwater (3.1.1-22)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.8)
SRP-LR Item No. (3.1.1-23) Deleted by LR-ISG-2011-04	N/A	N/A	N/A	N/A	N/A
SRP-LR Item No. (3.1.1-24) Deleted by LR-ISG-2011-04	N/A	N/A	N/A	N/A	N/A
Steel (with nickel-alloy cladding) or nickel alloy steam generator primary side components: divider plate and tube-to-tube sheet welds exposed to reactor coolant (3.1.1-25)	Cracking due to primary water stress corrosion cracking	Chapter XI.M2, “Water Chemistry”	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.2.11)
SRP-LR Item No. (3.1.1-26) Deleted by LR-ISG-2011-04	N/A	N/A	N/A	N/A	N/A
SRP-LR Item No. (3.1.1-27) Deleted by LR-ISG-2011-04	N/A	N/A	N/A	N/A	N/A
Stainless steel Combustion Engineering “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-28)	Loss of material due to wear; cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant (3.1.1-29)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and Chapter XI.M2, “Water Chemistry,” and for BWRs with a crevice in the access hole covers, augmented inspection using UT or other acceptable techniques	No	BWR Vessel Internals and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.1.2.1.2)
Stainless steel or nickel alloy penetration: drain line exposed to reactor coolant (3.1.1-30)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and Chapter XI.M2, “Water Chemistry”	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-31)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and Chapter XI.M2, “Water Chemistry”	No	One-Time Inspection and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel, nickel alloy, or CASS reactor vessel internals, core support structure (not already referenced in ASME Section XI Examination Category B-N-3 core support structure components in MRP-227-A), exposed to reactor coolant and neutron flux (3.1.1-32)	Cracking, or loss of material due to wear	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” or Chapter XI.M16A, “PWR Vessel Internals,” invoking applicable 10 CFR 50.55a and ASME Section XI inservice inspection requirements for these components	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding Class 1 reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-33)	Cracking due to stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for ASME components, and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel with stainless steel cladding pressurizer relief tank (tank shell and heads, flanges, nozzles) exposed to treated borated water >60°C (>140°F) (3.1.1-34)	Cracking due to stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for ASME components, and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-35)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel, stainless steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F) (3.1.1-36)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel reactor vessel flange (3.1.1-37)	Loss of material due to wear	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250 deg-C (>482 deg-F) (3.1.1-38)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components. For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary.	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, or steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-39)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal, mechanical, and vibratory loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, Chapter XI.M2, "Water Chemistry," and XI.M35, "One-time Inspection of ASME Code Class 1 Small-bore Piping"	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, Water Chemistry, and either Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping, or Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel with stainless steel or nickel alloy cladding; or stainless steel pressurizer components exposed to reactor coolant (3.1.1-40)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy core support pads; core guide lugs exposed to reactor coolant (3.1.1-40x)	Cracking due to primary water stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant (3.1.1-41)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel with stainless steel or nickel alloy cladding or stainless steel primary side components; steam generator upper and lower heads, and tube sheet weld; or pressurizer components exposed to reactor coolant (3.1.1-42)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant (3.1.1-43)	Loss of material due to pitting and crevice corrosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 1 components, and Chapter XI.M2, “Water Chemistry”	No	BWR Vessel Internals and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.1.2.1.3)
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-44)	Loss of material due to erosion	Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” for Class 2 components	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy and steel with nickel-alloy cladding reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-45)	Cracking due to primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry,” and, for nickel-alloy, Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced Corrosion in RCPB Components (PWRs Only)”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, nickel-alloy, nickel-alloy welds and/or buttering control rod drive head penetration pressure housing or nozzles safe ends and welds (inlet, outlet, safety injection) exposed to reactor coolant (3.1.1-46)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry,” and, for nickel-alloy, Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-induced corrosion in RCPB Components (PWRs Only)”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel, nickel-alloy control rod drive head penetration pressure housing exposed to reactor coolant (3.1.1-47)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M1, “ASME Section XI ISI, IWB, IWC & IWD,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel external surfaces: reactor vessel top head, reactor vessel bottom head, reactor coolant pressure boundary piping or components adjacent to dissimilar metal (Alloy 82/182) welds exposed to air with borated water leakage (3.1.1-48)	Loss of material due to boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion,” and Chapter XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in RCPB Components (PWRs Only)”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel reactor coolant pressure boundary external surfaces or closure bolting exposed to air with borated water leakage (3.1.1-49)	Loss of material due to boric acid corrosion	Chapter XI.M10, “Boric Acid Corrosion”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250 deg-C (>482 deg-F) (3.1.1-50)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy Babcock & Wilcox reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-51a)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Babcock & Wilcox reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-51b)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, fatigue, or overload	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-52a)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-52b)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Combustion Engineering reactor internal “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-52c)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Westinghouse reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-53a)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel Westinghouse reactor internal “Expansion” components exposed to reactor coolant and neutron flux (3.1.1-53b)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Westinghouse reactor internal “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-53c)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, or fatigue	Chapter XI.M16A, “PWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry” (for SCC mechanisms only)	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel bottom mounted instrument system flux thimble tubes (with or without chrome plating) exposed to reactor coolant and neutron flux (Westinghouse “Existing Programs” components) (3.1.1-54)	Loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals,” or Chapter XI.M37, “Flux Thimble Tube Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Babcock & Wilcox reactor internal “No Additional Measures” components exposed to reactor coolant and neutron flux (3.1.1-55a)	No additional aging management for reactor internal “No Additional Measures” components unless required by ASME Section XI, Examination Category B-N-3 or relevant operating experience exists	Chapter XI.M16a, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy Combustion Engineering reactor internal “No Additional Measures” components exposed to reactor coolant and neutron flux (3.1.1-55b)	No additional aging management for reactor internal “No Additional Measures” components unless required by ASME Section XI, Examination Category B-N-3 or relevant operating experience exists	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel alloy Westinghouse reactor internal “No Additional Measures” components exposed to reactor coolant and neutron flux (3.1.1-55c)	No additional aging management for reactor internal “No Additional Measures” components unless required by ASME Section XI, Examination Category B-N-3 or relevant operating experience exists	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Combustion Engineering reactor internal “Primary” components exposed to reactor coolant and neutron flux (3.1.1-56a)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) Combustion Engineering “Expansion” reactor internal components exposed to reactor coolant and neutron flux (3.1.1-56b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Combustion Engineering reactor internal “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-56c)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-57)	N/A	N/A	N/A	N/A	N/A

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Babcock & Wilcox reactor internal "Primary" components exposed to reactor coolant and neutron flux (3.1.1-58a)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to wear; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Babcock & Wilcox reactor internal "Expansion" components exposed to reactor coolant and neutron flux (3.1.1-58b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Westinghouse reactor internal "Primary" components exposed to reactor coolant and neutron flux (3.1.1-59a)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel (SS, including CASS, PH SS or martensitic SS) Westinghouse reactor internal "Expansion" components exposed to reactor coolant and neutron flux (3.1.1-59b)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, "PWR Vessel Internals"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel (SS, including CASS, PH SS or martensitic SS) or nickel alloy Westinghouse reactor internal “Existing Programs” components exposed to reactor coolant and neutron flux (3.1.1-59c)	Loss of fracture toughness due to neutron irradiation embrittlement and for CASS, martensitic SS, and PH SS due to thermal aging embrittlement; or changes in dimensions due to void swelling or distortion; or loss of preload due to thermal and irradiation enhanced stress relaxation or creep; or loss of material due to wear	Chapter XI.M16A, “PWR Vessel Internals”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-60)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Flow-Accelerated Corrosion An exception applies to the Flow-Accelerated Corrosion program	Consistent with the GALL Report
Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam (3.1.1-61)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-62)	Cracking due to stress corrosion cracking	Chapter XI.M18, “Bolting Integrity”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel or stainless steel closure bolting exposed to air with reactor coolant leakage (3.1.1-63)	Loss of material due to general (steel only), pitting, and crevice corrosion or wear	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Steel closure bolting exposed to air – indoor uncontrolled (3.1.1-64)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-65)	Loss of material due to wear	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
High-strength, low alloy steel, or stainless steel closure bolting; stainless steel control rod drive head penetration flange bolting exposed to air with reactor coolant leakage (3.1.1-66)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage (3.1.1-67)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Nickel alloy steam generator tubes exposed to secondary feedwater or steam (3.1.1-68)	Changes in dimension ("denting") due to corrosion of carbon steel tube support plate	Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam (3.1.1-69)	Cracking due to outer diameter stress corrosion cracking and intergranular attack	Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-70)	Cracking due to primary water stress corrosion cracking	Chapter XI.M19, "Steam Generators," and Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam (3.1.1-71)	Cracking due to stress corrosion cracking or other mechanism(s); loss of material due general (steel only), pitting, and crevice corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator tube support plate, tube bundle wrapper, supports, and mounting hardware exposed to secondary feedwater or steam (3.1.1-72)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater or steam (3.1.1-73)	Loss of material due to wastage and pitting corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator upper assembly and separators including feedwater inlet ring and support exposed to secondary feedwater or steam (3.1.1-74)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater or steam (3.1.1-75)	Wall thinning due to flow-accelerated corrosion and general corrosion	Chapter XI.M19, “Steam Generators,” and Chapter XI.M2, “Water Chemistry”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel, chrome plated steel, stainless steel, nickel alloy steam generator U-bend supports including anti-vibration bars exposed to secondary feedwater or steam (3.1.1-76)	Loss of material due to fretting	Chapter XI.M19, “Steam Generators”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy steam generator tubes and sleeves exposed to secondary feedwater or steam (3.1.1-77)	Loss of material due to wear and fretting	Chapter XI.M19, “Steam Generators”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	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 or steam (3.1.1-78)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection,” or Chapter XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD.”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-79)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel or steel with stainless steel cladding pressurizer relief tank: tank shell and heads, flanges, nozzles (none-ASME Section XI components) exposed to treated borated water >60°C (>140°F) (3.1.1-80)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel pressurizer spray head exposed to reactor coolant (3.1.1-81)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Nickel alloy pressurizer spray head exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel steam generator shell assembly exposed to secondary feedwater or steam (3.1.1-83)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant (3.1.1-84)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 exposed to reactor coolant (3.1.1-85)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-86)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel or nickel-alloy PWR reactor internal components exposed to reactor coolant and neutron flux (3.1.1-87)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-88)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-89)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-90)	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage (3.1.1-91)	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR)	Chapter XI.M3, "Reactor Head Closure Stud Bolting"	No	Reactor Head Closure Stud Bolting Exceptions apply to the Reactor Head Closure Stud Bolting program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage (3.1.1-92)	Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (PWR)	Chapter XI.M3, "Reactor Head Closure Stud Bolting"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Copper alloy >15% Zn or > 8% Al piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-93)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching "	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.1.2.1.1)
Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-94)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M4, "BWR Vessel ID Attachment Welds," and Chapter XI.M2, "Water Chemistry"	No	BWR Vessel ID Attachment Welds and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-95)	Cracking due to cyclic loading	Chapter XI.M5, "BWR Feedwater Nozzle"	No	BWR Feedwater Nozzle	Consistent with the GALL Report
Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant (3.1.1-96)	Cracking due to cyclic loading	Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle"	No	BWR Control Rod Drive Return Line Nozzle	Consistent with the GALL Report
Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds (3.1.1-97)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	BWR Stress Corrosion Cracking, Water Chemistry, and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.1.2.1.4)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant (3.1.1-98)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	Chapter XI.M8, “BWR Penetrations,” and Chapter XI.M2, “Water Chemistry”	No	BWR Penetrations and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Cast austenitic stainless steel; PH martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant and neutron flux (3.1.1-99)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Chapter XI.M9, “BWR Vessel Internals”	No	BWR Vessel Internals	Consistent with the GALL Report
Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant (3.1.1-100)	Loss of material due to wear	Chapter XI.M9, “BWR Vessel Internals”	No	BWR Vessel Internals	Consistent with the GALL Report
Stainless steel steam dryers exposed to reactor coolant (3.1.1-101)	Cracking due to flow-induced vibration	Chapter XI.M9, “BWR Vessel Internals” for steam dryer	No	BWR Vessel Internals	Consistent with the GALL Report
Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant (3.1.1-102)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M9, “BWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry”	No	BWR Vessel Internals and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux (3.1.1-103)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M9, “BWR Vessel Internals,” and Chapter XI.M2, “Water Chemistry”	No	BWR Vessel Internals and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux (3.1.1-104)	Cracking due to intergranular stress corrosion cracking	Chapter XI.M9, “BWR Vessel Internals” for core plate, and Chapter XI.M2, “Water Chemistry”	No	BWR Vessel Internals and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping element exposed to concrete (3.1.1-105)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.1.1)
Nickel alloy piping, piping components, and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage (3.1.1-106)	None	None	N/A – No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Stainless steel piping, piping components, and piping element exposed to gas, concrete, air with borated water leakage, air – indoors, uncontrolled (3.1.1-107)	None	None	N/A – No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-108)	N/A	N/A	N/A	N/A	N/A
The SRP-LR, as amended by ISGs, does not list an Item No. (3.1.1-109)	N/A	N/A	N/A	N/A	N/A
Any material, piping, piping components, and piping elements exposed to reactor coolant (3.1.1-110)	Wall thinning due to erosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.1.2.1.1)

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, Internals, and Reactor Coolant System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- BWR Control Rod Drive Return Line Nozzle
- BWR Feedwater Nozzle
- BWR Penetrations
- BWR Stress Corrosion Cracking
- BWR Vessel ID Attachment Welds
- BWR Vessel Internals
- Bolting Integrity
- Closed Treated Water Systems
- External Surfaces Monitoring of Mechanical Components
- Flow-Accelerated Corrosion
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- One-Time Inspection
- Selective Leaching
- Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping
- Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping
- Reactor Head Closure Stud Bolting
- Reactor Vessel Surveillance
- TLAA
- Water Chemistry

LRA Tables 3.1.2-1 through 3.1.2-3 summarize the AMR results for the Reactor Vessel, Internals, and Reactor Coolant System components and indicate AMRs that were claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report for those items that the staff determined were bounded by the GALL Report evaluation. However, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.1.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.1.1, items 3.1.1-2, 3.1.1-5, 3.1.1-8 through 3.1.1-10, 3.1.1-12, 3.1.1-15, 3.1.1-18 through 3.1.1-20, 3.1.1-22, 3.1.1-25, 3.1.1-28, 3.1.1-32 through 3.1.1-37, 3.1.1-40, 3.1.1-40x, 3.1.1-42, 3.1.1-44 through 3.1.1-49, 3.1.1-51a through 3.1.1-56c, 3.1.1-58a through 3.1.1-59c, 3.1.1-61, 3.1.1-62, 3.1.1-64 through 3.1.1-66, 3.1.1-68 through 3.1.1-78, 3.1.1-80 through 3.1.1-83, 3.1.1-86 through 3.1.1-90, 3.1.1-92, and 3.1.1-93, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to pressurized water reactors (PWRs). The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.1.1, items 3.1.1-16, 3.1.1-17, 3.1.1-21, 3.1.1-41, 3.1.1-50, and 3.1.1-105, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

LRA Table 3.1.1, item 3.1.1-110 addresses any material, piping, piping components, and piping elements exposed to reactor coolant. The GALL Report recommends GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," to manage wall thinning due to erosion for this component group. The applicant stated that this item is not applicable because there are no piping, piping components, and piping elements exposed to reactor coolant that have been identified as susceptible to wall thinning due to erosion in the Reactor Vessel, Internals, and Reactor Coolant System. The staff evaluated the applicant's claim and finds it acceptable because, during its audit, the staff searched the applicant's operating experience database and did not identify any components in the Reactor Vessel, Internals, and Reactor Coolant System that were experiencing wall thinning due to erosion.

3.1.2.1.2 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-29 addresses the nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant, which will be managed for cracking due to SCC, IGSCC, and IASCC. For the AMR item that cites generic note E, the LRA credits the BWR Vessel Internals program and the Water Chemistry program to manage the aging effects for the nickel alloy access hole cover. The GALL Report recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL Report AMP XI.M2, "Water Chemistry," to ensure that these aging effects are adequately managed.

GALL Report AMP XI.M1 recommends using periodic visual, surface, and/or volumetric examination along with GALL Report AMP XI.M2, which recommends monitoring and controlling known detrimental contaminants in accordance with the recommendations of BWRVIP-190 to manage the aging of this item.

For those AMR items associated with item 3.1.1-29 for which the applicant cited generic note E, the applicant substituted GALL Report AMP XI.M1 with the BWR Vessel Internals program. The applicant proposes to manage the aging of the nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant through inspections in accordance with component-specific BWRVIP reports that include industry-approved inspection procedures and flaw evaluations. The staff noted that the applicant will examine the core shroud access hole cover (welded covers) in accordance with BWRVIP-180, which requires the use of EVT-1 or UT. The staff also noted that the applicant's use of its Water Chemistry program is consistent with the recommendations of the GALL Report.

The staff's evaluations of the applicant's BWR Vessel Internals program and Water Chemistry program are documented in SER Sections 3.0.3.2.3 and 3.0.3.2.1, respectively.

Based on its review of components associated with item 3.1.1-29 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the BWR Vessel Internals program and Water Chemistry program acceptable because the BWR Vessel Internals program follows the inspection procedures, flaw evaluations, and repair guidelines of BWRVIP guidance and because the Water Chemistry program creates an environment that is not conducive for the occurrence of loss of material. These aging management activities are consistent with the recommendations of the GALL Report.

The staff concludes that for LRA item 3.1.1-29, 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 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.1.1, item 3.1.1-43 addresses stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the BWR Vessel Internals program and the Water Chemistry program to manage the aging effect for stainless steel and nickel alloy reactor vessel internals components. The GALL Report recommends GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL Report AMP XI.M2, "Water Chemistry," to ensure that this aging effect is adequately managed.

GALL Report AMP XI.M1 recommends using periodic visual, surface, and/or volumetric examination, along with GALL Report AMP XI.M2, which recommends monitoring and controlling known detrimental contaminants in accordance with the recommendations of BWRVIP-190 to manage the aging of this item. For those AMR items associated with item 3.1.1-43, for which the applicant cited generic note E, the applicant substituted GALL Report AMP XI.M1 with the BWR Vessel Internals program. The applicant proposes to manage the aging of stainless steel and nickel alloy reactor vessel internal components through inspections in accordance with component-specific BWRVIP reports that include industry-approved inspection procedures and flaw evaluations. The staff noted that the BWRVIP guidance requires the use of enhanced inspection methods, such as EVT-1 or UT, in lieu of the VT-1 or VT-3 required by inservice inspections. The staff also noted that the applicant's use of its Water Chemistry program is consistent with the recommendations of the GALL Report.

The staff's evaluations of the applicant's BWR Vessel Internals program and Water Chemistry program are documented in SER Sections 3.0.3.2.3 and 3.0.3.2.1, respectively.

Based on its review of components associated with item 3.1.1-43 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the BWR Vessel Internals program and Water Chemistry program acceptable because the BWR Vessel Internals program follows the inspection procedures, flaw evaluations, and repair guidelines of BWRVIP guidance and because the Water Chemistry program creates an environment not conducive for the occurrence of loss of material. These aging management activities are consistent with the recommendations of the GALL Report.

The staff concludes that, for LRA item 3.1.1-43, 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).

3.1.2.1.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-97 addresses stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to NPS 4-inches and reactor vessel nozzle safe ends and associated welds exposed to reactor coolant, which will be managed for cracking due to SCC (including IGSCC). For AMR items that cite generic note E, the LRA credits the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and the Water Chemistry programs to manage the aging effects for pump casings and valve bodies made of cast austenitic stainless steel or non-cast stainless steel. The GALL Report recommends GALL Report AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry," to ensure that the aging effect is adequately managed for these components. GALL Report AMP XI.M7 recommends conducting volumetric examinations on BWR piping and piping welds to detect and manage cracking due to SCC. GALL Report AMP XI.M2 recommends water chemistry controls to manage aging by limiting the concentrations of chemical species known to cause cracking due to SCC.

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 3.0.3.2.1, respectively. The staff noted that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program includes visual, surface, and volumetric examinations to manage the effects of aging for the pump casings and valve bodies. The staff also noted that the Water Chemistry program manages the effects of aging through the use of water chemistry control. Based on its review of the pump casings and valve bodies associated with item 3.1.1-97 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage aging using these proposed programs acceptable because the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program performs periodic inspections, which can detect and manage SCC, and because the Water Chemistry program limits the concentrations of chemical species (e.g., chloride and sulfate) known to cause SCC to minimize the environmental effect on SCC.

The staff concludes that, for LRA item 3.1.1-97, 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).

3.1.2.2 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, Internals, and Reactor Coolant System components and provided information on how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- cracking due to SCC and IGSCC
- crack growth due to cyclic loading
- cracking due to SCC
- cracking due to cyclic loading
- loss of material due to erosion
- cracking due to primary water stress corrosion cracking (PWSCC)
- QA for aging management of nonsafety-related components
- ongoing review of operating experience

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

LRA Section 3.1.2.2.1, associated with LRA Table 3.1.1 items 3.1.1-1, 3.1.1-4, 3.1.1-6, 3.1.1-7, and 3.1.1-11, addresses cumulative fatigue damage in Reactor Vessel, Internals, and Reactor Coolant System components. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions," and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.1.2.2.1 against the criteria in SRP-LR Section 3.1.2.2.1, which state that cumulative fatigue damage of Reactor Vessel, Internals, and Reactor Coolant System components is a TLAA and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage.

LRA Section 3.1.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of this TLAA is addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.1.2.2.1 and, therefore, is acceptable. The staff's evaluation of the TLAA for Reactor Vessel, Internals, and Reactor Coolant System components that are being managed for cumulative fatigue damage is documented in SER Section 4.3.

LRA Table 3.1.1, item 3.1.1-3, addresses stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux, which will be managed for cumulative fatigue damage due to fatigue. The GALL Report recommends that fatigue be evaluated as a TLAA to ensure that this aging effect is adequately managed.

LRA Table 3.1.2-3 provides the applicant's summary of the AMR for the Reactor Vessel Internals System. LRA Table 4.3.4-1 provides the bounding cumulative usage factor values for the reactor vessel internal components that have been analyzed for fatigue, including the values for the access hole cover and the core differential pressure and liquid control line. During its review of components associated with item 3.1.1-3, the staff noted that these two components are included in LRA Table 3.1.2-3. However, LRA Table 3.1.2-3 does not include cumulative fatigue damage as an AERM for either of these components.

By letter dated July 7, 2015, the staff issued RAI 3.1.2.2.1-1, requesting that the applicant justify why cumulative fatigue damage is not included as an AERM in LRA Table 3.1.2-3 for the access hole cover and the core differential pressure and liquid control line components or revise LRA Table 3.1.2-3 to include this effect for these components.

By letter dated August 6, 2015, the applicant responded to RAI 3.1.2.2.1-1. In its response, the applicant revised LRA Table 3.1.2-3 to include cumulative fatigue damage as an AERM for the access hole cover and the core differential pressure and liquid control line components. The applicant also reviewed its reactor internal components listed in LRA Table 4.3.4-1, and noted an additional inconsistency. The applicant also revised LRA Table 3.1.2-3 to include cumulative fatigue damage as an AERM for the control rod guide tube. For these AMR items, the applicant credited generic note A, which the staff noted is consistent with the recommendations in the GALL Report. The staff finds the applicant's response acceptable because LRA Table 3.1.2-3 was revised to include cumulative fatigue damage for all of the reactor internal components that were analyzed for fatigue, as provided in LRA Table 4.3.4-1. The staff's concerns in RAI 3.1.2.2.1-1 are resolved.

The staff concludes that, for LRA item 3.1.1-3, 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).

LRA Section 3.1.2.2.1, associated with LRA Table 3.1.1, items 3.1.1-2, 3.1.1-5, 3.1.1-8, 3.1.1-9, and 3.1.1-10, addresses cumulative fatigue damage in Reactor Vessel, Internals, and Reactor Coolant System components. The criteria in SRP-LR Section 3.1.2.2.1 state that cumulative fatigue damage of Reactor Vessel, Internals, and Reactor Coolant System components is a TLAA and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The applicant stated that these items are not applicable because they are associated only for PWR components. The staff evaluated the applicant's claim and finds it acceptable because the reactor design at LSCS is a BWR.

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 following criteria in SRP-LR Section 3.1.2.2.2:

Item 1. LRA Section 3.1.2.2.2, item 1, associated with LRA Table 3.1.1, item 3.1.1-12, addresses loss of material caused by general, pitting, and crevice corrosion in steel PWR steam generator upper and lower shells and transition cone exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the item is applicable only to PWRs and because the applicant's reactors are BWRs that do not have steam generators.

Item 2. LRA Section 3.1.2.2.2, item 2, associated with LRA Table 3.1.1, item 3.1.1-12, addresses loss of material caused by general, pitting, and crevice corrosion in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the item is applicable only to PWRs and because the applicant's reactors are BWRs that do not have steam generators.

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 following criteria in SRP-LR Section 3.1.2.2.3:

Item 1. LRA Section 3.1.2.2.3, item 1, associated with LRA Table 3.1.1, item 3.1.1-13, addresses steel reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux, which will be managed for loss of fracture toughness due to neutron irradiation embrittlement by the neutron embrittlement TLAA. SRP-LR Section 3.1.2.2.3, item 1, states that neutron irradiation embrittlement could occur for all ferric materials exposed to a neutron fluence greater than 1×10^{17} n/cm^2 ($E > 1$ MeV) at the end of the license renewal term. The SRP-LR also states that the TLAA for neutron irradiation embrittlement is required to be evaluated in accordance with 10 CFR 54.21(c)(1). The SRP-LR further states that this TLAA is addressed separately in SRP-LR Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis."

The applicant addressed the further evaluation criteria of the SRP-LR by stating that the evaluation of neutron irradiation embrittlement for all ferritic reactor vessel components that have a neutron fluence greater than $1x10^{17}$ n/cm^2 (E > 1 MeV) at the end of the license renewal term is performed as a TLAA as discussed in LRA Section 4.2.

It its review, the staff noted that LRA Table 3.1.2-2, "Reactor Vessel Summary of Aging Management Evaluation," adequately addresses AMR items to manage loss of fracture toughness due to neutron irradiation embrittlement for Reactor Vessel components by using the neutron embrittlement TLAA, consistent with GALL Report items IV.A1.R-62 and V.A1.R-67. The staff's evaluation of the applicant's neutron irradiation embrittlement TLAA for Reactor Vessel components is documented in SER Section 4.2 and its subsections.

In its review of Reactor Vessel components associated with LRA Table 3.1.1, item 3.1.1-13, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the neutron irradiation embrittlement TLAA is acceptable because the applicant's proposal is consistent with GALL Report items IV.A1.R-62 and V.A1.R-67 and the guidance in SRP-LR Section 3.1.2.2.3, item 1.

Item 2. LRA Section 3.1.2.2.3, item 2, associated with LRA Table 3.1.1, item 3.1.1-14, addresses the steel (with or without cladding) reactor vessel beltline shell and welds exposed to reactor coolant and neutron flux environment. The applicant stated that for the components associated with LRA Table 3.1.1, item 3.1.1-14, loss of fracture toughness caused by neutron irradiation embrittlement will be managed by the Reactor Vessel Surveillance program. The applicant also stated that the program meets the requirements of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," and that the embrittlement evaluations are performed in accordance with RG 1.99, Revision 2.

The applicable "acceptance criteria" provided in SRP-LR Section 3.1.2.2.3, item 2, states that loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux. The SRP-LR states that the reviewer verifies that the applicant has proposed an adequate reactor vessel material surveillance program for the period of extended operation.

The staff verified that the applicant included the applicable AMR items for the RV beltline components in LRA Table 3.1-1 and is crediting its Reactor Vessel Surveillance program to manage for loss of fracture toughness due to neutron irradiation embrittlement, consistent with the guidance provided in the GALL Report. In its review of components associated with LRA Table 3.1.1, item 3.1.1-14, the staff finds the applicant has met the further evaluation criteria of SRP-LR Section 3.1.2.2.3, item 2. The staff also noted that the applicant's AMP is based on compliance with the reactor vessel surveillance program and surveillance capsule withdrawal schedule requirements of Appendix H to 10 CFR Part 50. The staff's evaluation of the applicant's Reactor Vessel Surveillance program is documented in SER Section 3.0.3.1.8.

Based on the program identified, the staff concludes that the applicant meets the SRP-LR Section 3.1.2.2.3, item 2, criteria. For those items that apply to LRA Section 3.1.2.2.3, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will remain consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Item 3. LRA Section 3.1.2.2.3, item 3, associated with LRA Table 3.1.1, item 3.1.1-15, addresses reduction in fracture toughness for Babcock and Wilcox reactor internals. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the item is applicable only to PWRs and because the applicant's reactors are BWRs.

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 following criteria in SRP-LR Section 3.1.2.2.4:

Item 1. LRA Section 3.1.2.2.4, item 1, associated with LRA Table 3.1.1, item 3.1.1-16, addresses cracking due to SCC and IGSCC in stainless steel and nickel alloy top head enclosure vessel flange leak detection line exposed to air with reactor coolant leakage or reactor coolant. The criteria in SRP-LR Section 3.1.2.2.4, item 1, state that the GALL Report recommends that a plant-specific program be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC.

LRA Section 3.1.2.2.4, item 1, states that, because the leak detection line is fabricated with carbon steel, it is not susceptible to SCC or IGSCC. The staff evaluated the applicant's claim and finds it acceptable because LRA Table 3.1.1, item 3.1.1-16, and LRA Section 3.1.2.2.4, item 1, are not applicable to carbon steel.

Item 2. LRA Section 3.1.2.2.4, item 2, which is associated with LRA Table 3.1.1, item 3.1.1-17, addresses SCC and IGSCC for stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not used because the LSCS design does not have an isolation condenser. The staff reviewed the applicant's UFSAR and confirmed that the design of the applicant's unit does not include an isolation condenser; therefore, the staff finds the applicant's statement acceptable.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5, associated with LRA Table 3.1.1, item 3.1.1-18, addresses loss of material caused by general, pitting, and crevice corrosion in the steel PWR steam generator upper and lower shells and transition cone exposed to secondary feedwater and steam. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the item is applicable only to PWRs and because the applicant's reactors are BWRs that do not have steam generators.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

Item 1. LRA Section 3.1.2.2.6, item 1, associated with LRA Table 3.1.1, item 3.1.1-19, addresses cracking caused by SCC in PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because this item is associated only with PWRs.

Item 2. SRP-LR Section 3.1.2.2.6, item 2, associated with LRA Table 3.1.1, item 3.1.1-20, addresses cracking due to SCC that could occur in Class 1 PWR CASS reactor coolant system piping and piping components. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. In its review, the staff finds that this item is not applicable because the applicant's reactor type is a BWR.

3.1.2.2.7 Cracking Due to Cyclic Loading

LRA Section 3.1.2.2.7, which is associated with LRA Table 3.1.1, item 3.1.1-21, addresses cracking due to cyclic loading for steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not used because the LSCS design does not have an isolation condenser. The staff reviewed the applicant's UFSAR and confirmed that the design of the applicant's units does not include an isolation condenser; therefore, the staff finds the applicant's statement acceptable.

3.1.2.2.8 Loss of Material Due to Erosion

LRA Section 3.1.2.2.8, associated with LRA Table 3.1.1, item 3.1.1-22, addresses loss of material due to erosion in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The applicant stated that this item is not applicable because the associated item in LRA Table 3.1.1 is applicable to PWRs only. The staff evaluated the applicant's claim and finds it acceptable because the item is applicable only to PWRs and because the applicant's reactors are BWRs that do not have steam generators.

3.1.2.2.9 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.10 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

Item 1. LRA Section 3.1.2.2.11, item 1, associated with LRA Table 3.1.1, item 3.1.1-25, addresses cracking due to PWSCC that could occur in steam generator divider plates and associated welds fabricated of nickel alloys. The LRA states that this item is not applicable because it applies to PWRs only. In its review, the staff finds the applicant's determination acceptable because the applicant's reactor type is a BWR.

Item 2. LRA Section 3.1.2.2.11, item 2, associated with Table 3.1.1 Item 3.1.1-20, addresses cracking due to PWSCC that could occur in steam generator tube-to-tube sheet welds fabricated of nickel alloys. The LRA states that this item is not applicable because it applies to PWRs only. In its review, the staff finds the applicant's determination acceptable because the applicant's reactor type is a BWR.

3.1.2.2.12 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.13 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.14 This paragraph for further evaluation from the SRP-LR was removed by LR-ISG-2011-04.

3.1.2.2.15 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.

3.1.2.2.16 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

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 that are not consistent with or are not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-3, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does not correspond to any 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.

3.1.2.3.1 Reactor Coolant Pressure Boundary 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 Reactor Coolant Pressure Boundary System component groups.

<u>Cast Austenitic Stainless Steel Flow Devices (Flow Restrictors) Exposed to Steam</u>. In LRA Table 3.1.2-1, the applicant stated that the main steam line flow restrictors, which are fabricated of cast austenitic stainless steel (CASS), will be managed for loss of material due to erosion by

a plant-specific TLAA for the components. The AMR item cites generic note H, indicating that the loss of material aging effect is not described for this component, material, and environment combination in the GALL Report. The AMR item cites plant specific note 5, which indicates that the plant-specific TLAA for the components is included in Section 4.7 of the LRA.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed cracking in the main steam line flow restrictors and other mechanisms that could potentially induce loss of material in the flow restrictors in other AMR items in LRA Table 3.1.2 1. The staff finds that the applicant has identified all other credible aging effects and mechanisms for this component, material, and environment combination consistent with the GALL Report.

For the management of loss of material due to erosion, the staff confirmed that the applicant is managing the aging effect using a plant-specific TLAA, as defined and discussed in Section 4.7.2 of the LRA. The staff finds the applicant's proposal to manage loss of material due to erosion using the TLAA acceptable because the applicant has projected the amount of erosion that will occur in the components to the end of the period of extended operation consistent with the requirements in 10 CFR 54.21(c)(1)(ii). The staff evaluates this TLAA in SER Section 4.7.2.

3.1.2.3.2 Reactor Vessel – 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 Reactor Vessel component groups.

Carbon or Low Alloy Steel Exposed to Indoor Air. In LRA Table 3.1.2-2, the applicant stated that, for carbon or low alloy steel reactor vessel components exposed to indoor air (external), loss of material is not applicable and that no AMPs are proposed. The AMR items cite generic note I. The AMR items also cite plant-specific note 1, which states that, during power operation, the insulated reactor components have an external temperature greater than 212 °F and are at a higher temperature than that of the indoor air and that, during plant shutdown, the containment atmosphere is normally below the dew-point temperature. Plant-specific note 1 further states that, because of the pertinent conditions described, wetting due to condensation will not occur; therefore, loss of material due to corrosion is not applicable.

The staff reviewed the associated items in the LRA to confirm that the aging effect is not applicable for this component, material, and environment combination. The staff noted that moisture accumulation is not expected to occur on the reactor vessel components under the atmospheric conditions described. The staff further noted that in the absence of moisture or condensation, corrosion will not occur. Therefore, the staff finds the applicant's proposal acceptable.

3.1.2.3.3 Reactor Vessel Internals – 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 Reactor Vessel Internals component groups.

Stainless Steel Bolting, Stainless Steel, or X-750 Alloy Exposed to Reactor Coolant and Neutron Flux. In LRA Table 3.1.2-3, the applicant stated that the core plate bolts (rim hold-down bolts), jet pump riser brace clamps, and jet pump slip joint clamps – all of which are fabricated of stainless steel and X-750 alloy and exposed to the reactor coolant and neutron flux – will be managed for loss of preload due to neutron irradiation by the TLAAs for reactor vessel internals. The AMR item cites generic note H, indicating that the loss of preload aging effect is not described for this component, material, and environment combination in the GALL Report. The AMR item cites plant-specific notes 3 and 4, which indicate that LRA Section 4.2 on TLAAs of neutron irradiation effects addresses aging management of these reactor vessel internals exposed to neutron fluence.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed cracking, cumulative fatigue, loss of material, and loss of fracture toughness for this component, material, and environment combination in other AMR items in LRA Table 3.1.2-3. The staff finds that the applicant has identified all other credible aging effects for this component, material, and environment combination consistent with the GALL Report.

The staff's evaluation of the applicant's TLAAs for loss of material in the core plate rim hold-down bolts, jet pump riser brace clamps, and jet pump slip joint clamps are documented in SER Sections 4.2.8, 4.2.9, and 4.2.10, respectively. The staff finds the applicant's proposal to manage loss of preload using the TLAAs acceptable because (1) the applicant demonstrated that the loss of preload analyses for the core plate rim hold-down bolts and jet pump riser brace clamps remain valid through the period of extended operation and (2) the analysis for the jet pump slip joint clamps will be revised for a higher acceptable neutron fluence value or other correction actions, such as repair or replacement of the clamps, will be performed to ensure acceptable clamp preload as specified in Commitment No. 47 in the UFSAR supplement.

X-750 Alloy Jet Pump Assemblies: Inlet Riser and Brace, Hold-Down Beam, Diffuser, Tailpipe, Wedges, and Repair Components Exposed to Reactor Coolant and Neutron Flux. In LRA Table 3.1.2-3, the applicant stated that X-750 alloy jet pump assemblies (i.e., inlet riser and brace, hold-down beam, diffuser, tailpipe, wedges, and repair components) exposed to reactor coolant and neutron flux will be managed for loss of material by the BWR Vessel Internals program. The AMR item cites generic note F and plant-specific note 5, which state that the BWR Vessel Internals program is used to manage loss of material due to wear of X-750 alloy replacement jet pump main wedges and auxiliary wedges.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed cracking, cumulative fatigue damage, loss of fracture toughness, and loss of preload for this component, material, and environment combination in other AMR items in LRA Table 3.1.2-3. Based on its review of the GALL Report and BWRVIP-41, which state that this component, material, and environmental combination is susceptible to loss of fracture toughness and cracking, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's BWR Vessel Internals program is documented in SER Section 3.0.3.2.3. The staff noted that the GALL Report recommends GALL Report AMP XI.M9, "BWR Vessel Internals," to manage loss of material for stainless steel and nickel alloy jet pump components exposed to reactor coolant and neutron flux. The staff finds the applicant's proposal to manage the effects of aging using the BWR Vessel Internals program acceptable because the visual inspections required by BWRVIP-41 are capable of detecting loss of material of the jet pump assemblies and because inspection frequency recommended by BWRVIP-41 ensures that the functionality of the jet pump assemblies will be monitored.

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 Reactor Coolant System 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).

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 of the following:

- High Pressure Core Spray System
- Low Pressure Core Spray System
- Reactor Core Isolation Cooling System
- Residual Heat Removal System
- Standby Gas Treatment System

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF systems components. LRA Table 3.2.1, "Summary of Aging Management Evaluations for the Engineered Safety Features," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the ESF systems components.

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.

3.2.2 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 the applicant's AMRs to verify the applicant's claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.2-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or require no aging management are noted in Table 3.2-1 and discussed in SER Section 3.2.2.1.1. Details of the staff's evaluation of AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information are documented in SER Section 3.2.2.1.2.

During its review, the staff also reviewed AMRs that are consistent with the GALL Report and those 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 of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with, or are 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 of AMRs that are not consistent with, or are not addressed in, the GALL Report are documented in SER Section 3.2.2.3.

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 (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel piping, piping components, and piping elements exposed to treated water (borated) (3.2.1-1)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)).	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.2.2.2.1)
Steel (with stainless steel cladding) pump casings exposed to treated water (borated) (3.2.1-2)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel partially-encased tanks with breached moisture barrier exposed to raw water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottom because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.2.3)
Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor (3.2.1-4)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.2.2.2.3)
Stainless steel orifice (miniflow recirculation) exposed to treated water (borated) (3.2.1-5)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging. See LER 50-275/94-023 for evidence of erosion.	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.2.4)
Steel drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to air – indoor, uncontrolled (internal) (3.2.1-6)	Loss of material due to general corrosion; fouling that leads to corrosion	A plant-specific aging management program is to be evaluated	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.2.5)
Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor (3.2.1-7)	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.2.2.2.6)
Aluminum, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-8)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel external surfaces, bolting exposed to air with borated water leakage (3.2.1-9)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated) >250°C (>482°F), treated water >250°C (>482°F) (3.2.1-10)	Loss of fracture toughness due to thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel piping, piping components, and piping elements exposed to steam, treated water (3.2.1-11)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion An exception applies to the Flow-Accelerated Corrosion	Consistent with the GALL Report
Steel, high-strength closure bolting exposed to air with steam or water leakage (3.2.1-12)	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external) (3.2.1-13)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.2.1-14)	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Copper alloy, nickel alloy, steel; stainless steel, stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water, air – indoor, uncontrolled (external) (3.2.1-15)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel containment isolation piping and components (internal surfaces), piping, piping components, and piping elements exposed to treated water (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Aluminum, stainless steel piping, piping components, and piping elements exposed to treated water (3.2.1-17)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection, Water Chemistry, and Bolting Integrity An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.2.2.1.2)
Stainless steel containment isolation piping and components (internal surfaces) exposed to treated water (3.2.1-18)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water, treated water (borated) (3.2.1-19)	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements; tanks exposed to treated water (borated) >60°C (>140°F) (3.2.1-20)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Steel (with stainless steel or nickel-alloy cladding) safety injection tank (accumulator) exposed to treated water (borated) >60°C (>140°F) (3.2.1-21)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements; tanks exposed to treated water (borated) (3.2.1-22)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water (3.2.1-23)	Loss of material due to general, pitting, crevice, and microbiologically - influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-24)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water (3.2.1-25)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel heat exchanger tubes exposed to raw water (3.2.1-26)	Reduction of heat transfer due to fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel, steel heat exchanger tubes exposed to raw water (3.2.1-27)	Reduction of heat transfer due to fouling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F) (3.2.1-28)	Cracking due to stress corrosion cracking	Chapter XI.M21A, “Closed Treated Water Systems”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel Piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-29)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.2.1-30)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-31)	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Copper alloy heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-32)	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Closed Treated Water Systems	Consistent with the GALL Report
Copper alloy, stainless steel heat exchanger tubes exposed to closed-cycle cooling water (3.2.1-33)	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to closed-cycle cooling water (3.2.1-34)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Gray cast iron motor cooler exposed to treated water (3.2.1-35)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water (3.2.1-36)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-37)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Elastomers, elastomer seals and components exposed to air – indoor, uncontrolled (external) (3.2.1-38)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel containment isolation piping and components (external surfaces) exposed to condensation (external) (3.2.1-39)	Loss of material due to general corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel ducting, piping, and components (external surfaces), ducting, closure bolting, containment isolation piping and components (external surfaces) exposed to air – indoor, uncontrolled (external) (3.2.1-40)	Loss of material due to general corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Steel external surfaces exposed to air – outdoor (external) (3.2.1-41)	Loss of material due to general corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Aluminum piping, piping components, and piping elements exposed to air – outdoor (3.2.1-42)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Elastomers, elastomer seals and components exposed to air – indoor, uncontrolled (internal) (3.2.1-43)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel piping and components (internal surfaces), ducting and components (internal surfaces) exposed to air – indoor, uncontrolled (internal) (3.2.1-44)	Loss of material due to general corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel encapsulation components exposed to air – indoor, uncontrolled (internal) (3.2.1-45)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Steel piping and components (internal surfaces) exposed to condensation (internal) (3.2.1-46)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel encapsulation components exposed to air with borated water leakage (internal) (3.2.1-47)	Loss of material due to general, pitting, crevice, and boric acid corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements (internal surfaces); tanks exposed to condensation (internal) (3.2.1-48)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-49)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Lubricating Oil Analysis and One-Time Inspection	Consistent with the GALL Report
Copper alloy, stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-50)	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Lubricating Oil Analysis and One-Time Inspection	Consistent with the GALL Report
Steel, copper alloy, stainless steel heat exchanger tubes exposed to lubricating oil (3.2.1-51)	Reduction of heat transfer due to fouling	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Lubricating Oil Analysis and One-Time Inspection	Consistent with the GALL Report
Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete (3.2.1-52)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete (3.2.1-53)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping	Consistent with the GALL Report
Steel, stainless steel, nickel alloy underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external) (3.2.1-53x)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F) (3.2.1-54)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	BWR Stress Corrosion Cracking, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to concrete (3.2.1-55)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Aluminum piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external) (3.2.1-56)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), gas (3.2.1-57)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Copper alloy (≤15% Zn and ≤8% Al) piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-58)	None	None	NA - No AEM or AMP	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.2.2.1.1)
Galvanized steel ducting, piping, and components exposed to air – indoor, controlled (external) (3.2.1-59)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Glass piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, raw water, treated water, treated water (borated), air with borated water leakage, condensation (internal/external), gas, closed-cycle cooling water, air – outdoor (3.2.1-60)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) (3.2.1-61)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-62)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air with borated water leakage, concrete, gas, air – indoor, uncontrolled (internal) (3.2.1-63)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801	Consistent with the GALL Report
Steel Piping, piping components, and piping elements exposed to air – indoor, controlled (external), gas (3.2.1-64)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated) (3.2.1-65)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow- Accelerated Corrosion An exception applies to the Flow-Accelerated Corrosion program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metallic piping, piping components, and tanks exposed to raw water or waste water (3.2.1-66)	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.2.9)
Stainless steel or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.2.1-67)	Cracking due to stress corrosion cracking	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.2.1-68)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Insulated steel, stainless steel, copper alloy, or aluminum, piping, piping components, and tanks exposed to condensation, air-outdoor (3.2.1-69)	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components” or Chapter XI.M29, “Aboveground Metallic Tanks,” (for tanks only)	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to treated water, treated borated water (3.2.1-70)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor (3.2.1-71)	Cracking due to stress corrosion cracking	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components” or Chapter XI.M29, “Aboveground Metallic Tanks,” (for tanks only)	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.2.2.1.1)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.2.1-72)	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used by LSCS (see SER Section 3.2.2.3.3)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.2.1-73)	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used by LSCS (see SER Section 3.2.2.1.1)
Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water (3.2.1-74)	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used by LSCS (see SER Section 3.2.2.1.1)

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:

- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring of Mechanical Components
- Flow-Accelerated Corrosion

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Lubricating Oil Analysis
- One-Time Inspection
- Selective Leaching
- Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program
- TLAA
- Water Chemistry

LRA Tables 3.2.2-1 through 3.2.2-5 summarize the results of AMRs for the ESF systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report for those items that the staff determined were bounded by the GALL Report evaluation. However, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.2.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.2.1, items 3.2.1-2, 3.2.1-3, 3.2.1-5, 3.2.1-8, 3.2.1-9, 3.2.1-20 through 3.2.1-22, 3.2.1-24, 3.2.1-35, 3.2.1-36, 3.2.1-45, 3.2.1-47, and 3.2.1-58, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.2.1, items 3.2.1-10, 3.2.1-14, 3.2.1-18, 3.2.1-23, 3.2.1-25 through 3.2.1-29, 3.2.1-31, 3.2.1-33, 3.2.1-34, 3.2.1-37, 3.2.1-39, 3.2.1-41 through 3.2.1-44, 3.2.1-52, 3.2.1-53x, 3.2.1-55, 3.2.1-59, 3.2.1-62, 3.2.1-64, and 3.2.1-67 through 3.2.1-71, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

SER Table 3.2-1, items 3.2.1-73 and 3.2.1-74, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers and Tanks." The ISG added these items to allow applicants to credit the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. The applicant did not credit the related plant-specific AMP, "Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program," for the aging effect and components that reference SRP-LR items 3.2.1-73 and 3.2.1-74; instead, it credited alternate items and programs to manage the effects of these aging mechanisms for these components. For example, loss of material for the internally coated RCIC turbine lube oil reservoirs is managed by the Lubricating Oil Analysis and One-Time Inspection programs. The staff finds this approach acceptable because the alternate items and programs used are adequate to manage the effects of aging for these components and because this approach is consistent with GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks."

For the LRA Table 3.2.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable. For these items, the staff reviewed sources beyond the LRA and UFSAR or issued one or more RAIs, or both, in order to verify the applicant's claim of non-applicability.

LRA Table 3.2.1, item 3.2.1-14 addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends GALL Report 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 there is no steel closure bolting exposed to air with steam or water leakage in the ESF systems. The staff evaluated the applicant's claim and notes that the possibility for the steel closure bolts in the ESF systems to be exposed to an air with steam or water leakage environment during the period of extended operation cannot be eliminated. However, the staff finds that the steel closure bolts in the ESF systems will be adequately age managed for loss of material due to general corrosion and finds the non-applicability of LRA item 3.2.1-14 acceptable because of the following:

- Through LRA Table 3.2.1, items 3.2.1-13 and 3.2.1-40, the applicant will use the Bolting Integrity and External Surfaces Monitoring of Mechanical Components programs to manage loss of material of all closure bolting in the ESF systems.
- Both programs conduct periodic visual inspections, which are capable of detecting loss of material due to general corrosion in closure bolting.
- Use of these programs is consistent with GALL Report recommendations.

3.2.2.1.2 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.2.1, item 3.2.1-17, addresses aluminum and stainless steel piping, piping components, and piping elements exposed to treated water, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the Bolting Integrity program to manage the aging effects for stainless steel bolting in the High Pressure Core Spray, Low Pressure Core Spray, Reactor Core Isolation Cooling, and the Residual Heat Removal Systems. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection," programs to ensure that this aging effect is adequately managed. GALL Report AMP XI.M2 recommends using periodic monitoring of the treated water in order to minimize loss of material or cracking to manage the effects of aging. GALL Report AMP XI.M32 recommends performing one-time nondestructive examinations to verify the effectiveness of AMP XI.M2.

The staff's evaluation of the applicant's Bolting Integrity program is documented in SER Section 3.0.3.2.4. The staff noted that the Bolting Integrity program proposes to manage the effects of aging for stainless steel bolting through the use of periodic inspections for indication of loss of material due to pitting and crevice corrosion. However, the applicant did not state the parameters, sample size, or frequency of inspections to be performed on submerged bolting for item 3.2.1-17, which addresses submerged bolting in several ESF systems. By letter dated July 7, 2015, the staff issued RAI 3.2.2.1.1-1, requesting that the applicant provide the parameters for visual inspections, clarify whether a representative sample will be removed and inspected, and justify the inspection frequency for submerged bolting.

In its response dated August 6, 2015, the applicant stated that the design of the submerged bolting for the suction strainers in the ESF systems called for these bolts to be torqued and then "staked" (either by purposeful distortion of the threads beyond the nut or by spot welding the nut to the bolt) to prevent them from loosening. In addition, the geometry of these bolted connections allows for visual inspection of a portion of the bolt shanks between the flanges of the strainer and the associated suction piping. The applicant stated that the existing diver inspection procedures will be enhanced to include a requirement to verify that the nuts continue to be “staked” by physical manipulation to ensure the nuts are not loose and to require visual inspection of the bolt heads, nuts, and threaded bolt shank, where accessible. In addition, the applicant stated that the existing repetitive tasks, which will be enhanced to include diver inspections of all suction strainer bolting, are scheduled at least once each 10-year ISI interval. The applicant stated by verifying that the associated bolts remain “staked,” that physical manipulation shows they are not loose, and that the bolt surfaces do not show any loss of material will be adequate to ensure that the bolting has not lost preload and to detect loss of material without removal of the bolts. In addition, the 10-year frequency is comparable to other AMPs for which only limited samples are inspected during each 10-year period.

The staff notes that aging management of submerged bolting in several auxiliary systems is also addressed in the applicant’s response to RAI 3.2.2.1.1-1 and that these components are discussed in SER Section 3.3.2.1.5. The staff finds the applicant’s response acceptable because the proposed changes to the inspection details and frequency of the existing diver inspection procedure will ensure that degradation of submerged bolting will be identified. The staff’s concerns described in RAI 3.2.2.1.1-1 are resolved.

The staff concludes that, for LRA item 3.2.1-17, 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).

3.2.2.2 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 provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to cladding breach
- loss of material due to pitting and crevice corrosion
- loss of material due to erosion
- loss of material due to general corrosion and fouling that leads to corrosion
- cracking due to SCC
- QA for aging management of nonsafety-related components
- ongoing review of operating experience
- loss of material due to recurring internal corrosion

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 3.2.2.2. The staff’s review of the applicant’s further evaluation follows.

3.2.2.2.1 Cumulative Fatigue Damage

LRA Section 3.2.2.2.1 is associated with LRA Table 3.2.1, item 3.2.1-1, which addresses cumulative fatigue damage management for the Control Rod Drive, High Pressure Core Spray, Low Pressure Core Spray, Reactor Coolant Pressure Boundary, Reactor Core Isolation Cooling, Reactor Water Cleanup, and Residual Heat Removal Systems. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions," and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.2.2.2.1 against the criteria in SRP-LR Section 3.2.2.2.1, which state that cumulative fatigue damage of engineered safety features is a TLAA and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage.

LRA Section 3.2.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.2.2.2.1 and, therefore, is acceptable. The staff's evaluation of the TLAA for the Control Rod Drive, High Pressure Core Spray, Low Pressure Core Spray, Reactor Coolant Pressure Boundary, Reactor Core Isolation Cooling, Reactor Water Cleanup, and Residual Heat Removal systems that are being managed for cumulative fatigue damage is documented in SER Section 4.3.

3.2.2.2.2 Loss of Material Due to Cladding Breach

LRA Section 3.2.2.2.2, associated with LRA Table 3.2.1, item 3.2.1-2, addresses loss of material due to cladding breach in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The applicant stated that this item is not applicable because it only applies to PWRs. The staff confirmed that this item is associated only with PWR plants and that the applicant's reactor type is a BWR; therefore, the staff finds the applicant's determination acceptable.

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:

Item 1. LRA Section 3.2.2.2.3, associated with LRA Table 3.2.1, item 3.2.1-3, addresses loss of material in partially encased stainless steel tanks exposed to raw water. The criteria in SRP-LR Section 3.2.2.2.3, item 1, recommend that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. The applicant stated that this item is not applicable because the item is only applicable to PWR plants and because there are no partially encased stainless steel tanks exposed to raw water in the ESF systems. The staff evaluated the applicant's claim and finds it acceptable because, based on a review of LRA Section 3.2 and the UFSAR, there are no partially encased stainless steel tanks exposed to raw water in the ESF systems.

Item 2. LRA Section 3.2.2.2.3, item 2, associated with LRA Table 3.2.1, item 3.2.1-4, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.2.2.2.3, item 2, state that loss of material could occur for stainless steel components exposed to outdoor air environments that containing sufficient halide and environments in which condensation or deliquescence is possible. The SRP-LR further states that GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and is within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to outdoor air in the Reactor Core Isolation Cooling System.

The staff’s evaluation of the applicant’s External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant’s External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.2.1-4, the staff finds that the applicant has met the further evaluation criteria and that the applicant’s proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant’s program includes periodic inspections that can detect loss of material due to pitting and crevice corrosion.

Based on the program identified, the staff determines that the applicant’s program meets SRP-LR Section 3.2.2.2.3, item 2, criteria. For those components associated with LRA Section 3.2.2.2.3, item 2, the staff concludes that 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 Loss of Material Due to Erosion

LRA Section 3.2.2.2.4, associated with LRA Table 3.2.1, item 3.2.1-5, addresses stainless steel high-pressure safety injection pump minimum flow recirculation orifices exposed to treated borated water. The applicant stated that item 3.2.1-5 is not applicable because it only applies to PWRs. The staff evaluated the applicant’s claim and finds it acceptable because item 3.2.1-5 addresses the use of the high-pressure safety injection pumps for normal charging in PWRs and does not apply to LSCS.

3.2.2.2.5 Loss of Material Due to General Corrosion and Fouling That Leads to Corrosion

LRA Section 3.2.2.2.5, associated with LRA Table 3.2.1, item 3.2.1-6, addresses loss of material due to general corrosion and fouling that leads to corrosion in steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air. The applicant stated that, for item 3.2.1-6, the applicability is limited to steel orifices or spray nozzles exposed to indoor air and, therefore, is not applicable. The staff confirmed that the applicant’s containment spray nozzles are stainless steel and that no steel orifices are present in the containment spray subsystem.

However, the staff noted that this further evaluation subsection includes plugging of the spray nozzles and discusses internal surface corrosion of the steel spray systems in the drywell and suppression chamber. The staff also noted that nozzle plugging can be caused by the buildup of corrosion products from upstream components, not just corrosion of the nozzles themselves. The staff further noted that even though this system is in standby for the majority of time, the wetting and drying of these components can accelerate corrosion and lead to flow blockage due to fouling. Based on this, by letter dated July 27, 2015, the staff issued RAI 3.2.2.2.5-1, requesting that the applicant provide the bases for not needing a plant-specific AMP to manage plugging of spray nozzles caused by accelerated corrosion of steel components upstream of the nozzles due to occasional wetting and drying. In addition, the RAI asked the applicant to clarify which environment (condensation or treated water) is being considered and to discuss whether the suppression pool spray header will be considered as a unique environment due to the variations in flow or to provide the bases for considering it as part of a larger population from a sampling perspective.

In its response dated August 26, 2015, the applicant stated that plugging of the drywell and suppression pool spray nozzles will be managed by the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The applicant also stated that it does not consider the environment for these spray nozzles to be unique, but it did consider "flow blockage" as a unique aging effect that warranted a separate population for a sample within the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The applicant revised LRA Sections A.2.1.25 and B.2.1.25 to include flow blockage of the spray nozzles in the associated AMP and revised Table 3.2.2-4, "Residual Heat Removal System Summary of Aging Management Evaluation," to include "flow blockage" as an AERM for the stainless steel spray nozzles in the drywell and suppression pool. The staff notes that the new AMR item added to Table 3.2.2-4 cites generic note H, indicating that the aging effect is not in the GALL Report for this component, material, and environment combination.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.13. The staff finds the response acceptable because the applicant included flow blockage as an additional AERM and revised the above AMP to include this aging effect in periodic sampling for the program. The staff's concerns described in RAI 3.2.2.2.5-1 are resolved.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.2.2.2.5. For those items associated with LRA Section 3.2.2.2.5, the staff concludes 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).

3.2.2.2.6 Cracking Due to Stress Corrosion Cracking

LRA Section 3.2.2.2.6, associated with LRA Table 3.2.1, item 3.2.1-7, addresses cracking due to SCC in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.2.2.2.6 state that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and environments in which condensation or deliquescence is possible. The SRP-LR further states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage cracking due to

SCC in stainless steel piping, piping components, and piping elements exposed to outdoor air in the Reactor Core Isolation Cooling System.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant's External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.2.1-7, the staff finds that the applicant has met the further evaluation criteria and that its proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant's program includes periodic inspections, which can detect cracking due to SCC.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.2.2.2.6 criteria. For those components associated with LRA Section 3.2.2.2.6, the staff concludes 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).

3.2.2.2.7 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.

3.2.2.2.8 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

3.2.2.2.9 Loss of Material Due to Recurring Internal Corrosion

LRA Section 3.2.2.2.9, associated with LRA Table 3.2.1, item 3.2.1-66, addresses loss of material due to recurring internal corrosion in metallic piping, piping components, and tanks exposed to raw or waste water. The criteria in SRP-LR Section 3.2.2.2.9 state that AMPs may need to be augmented beyond the recommendations in the GALL Report if recurring internal corrosion is identified during searches of plant-specific operating experience conducted for the development of the LRA. The applicant stated that this item is not applicable because its review of operating experience for Engineered Safety Features systems did not identify instances of recurring internal corrosion with the threshold frequency specified in LR-ISG-2012-02. The staff evaluated the applicant's claim and finds it acceptable because, as noted in the AMP Audit Report, the staff conducted an independent search of the past 10 years of operating experience reports and did not identify repetitive occurrences of internal corrosion in Engineered Safety Features systems with a frequency greater than that given in LR-ISG-2012-02.

3.2.2.3 Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-5, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations that are not consistent with, or are not addressed in, the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-5, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does 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 that are 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 High Pressure Core 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 High Pressure Core Spray System component groups.

Zinc Piping, Piping Components, and Piping Elements Exposed to Uncontrolled Indoor Air. In LRA Tables 3.2.2-1, 3.2.2-2, and 3.2.2-3, the applicant stated that zinc casting piping, piping components, and piping elements exposed to uncontrolled indoor air are not subject to any AERM. The AMR items cite generic note F. The AMR items also cite plant-specific note 3, which states that even though there is no expected aging effect for the zinc components exposed to indoor air, the External Surfaces Monitoring of Mechanical Components program will be used to ensure the absence of any aging effects.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that, although zinc alloys have good corrosion resistance under atmospheric conditions, the applicant has proposed to use the External Surfaces Monitoring of Mechanical Components program to ensure that aging is not occurring. The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposal to monitor any potential aging effect using the External Surfaces Monitoring of Mechanical Components program acceptable because the periodic inspections conducted by the program are capable of detecting loss of material, cracking, and other surface degradation if it is occurring.

Zinc Piping, Piping Components, and Piping Elements Exposed to Lubricating Oil. In LRA Tables 3.2.2-1, 3.2.2-2, and 3.2.2-3, the applicant stated that zinc piping, piping components, and piping elements exposed internally to lubricating oil will be managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection programs. The AMR items cite generic note F with a plant-specific note 4, which states that "the component is zinc casting exposed to lubricating oil and is susceptible to loss of material."

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which states that galvanized steel (i.e., steel coated with a protective zinc coating) exposed to outdoor air (i.e., condensation) should be managed for loss of material, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Lubricating Oil Analysis and One-Time Inspection programs is documented in SER Sections 3.0.3.1.14 and 3.0.3.1.9, respectively. The staff finds the applicant's proposal to manage the effects of aging using the Lubricating Oil Analysis and One-Time Inspection programs acceptable because lubricating oil testing (sampling and analysis) and condition monitoring will identify detrimental contaminants, such as water, sediments, specific wear elements, and elements from an outside source. The contaminant levels are trended in the program's database, and recommendations are made when adverse trends are observed, which could include in-leakage and corrosion product buildup. Additionally, the One-Time Inspection program that will be used to verify the system-wide effectiveness of the Lubricating Oil Analysis program by inspections focusing on locations that are isolated from the flow stream, that are stagnant, or that have low flow for extended periods of time and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects.

3.2.2.3.2 Low Pressure Core Spray 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 Low Pressure Core Spray System component groups.

<u>Zinc Piping, Piping Components, and Piping Elements Exposed to Uncontrolled Indoor Air</u>. The staff's evaluation for zinc piping, piping components, and piping elements exposed to uncontrolled indoor air, which will be managed by the External Surfaces Monitoring of Mechanical Components program and is associated with generic note F, is documented in SER Section 3.2.2.3.1.

<u>Zinc Piping, Piping Components, and Piping Elements Exposed to Lubricating Oil</u>. The staff's evaluation of zinc piping, piping components, and piping elements exposed to lubricating oil, which will be managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection programs and is associated with generic note F, is documented in SER Section 3.2.2.3.1.

3.2.2.3.3 Reactor Core Isolation Cooling System – Summary of Aging Management Evaluation – LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the Reactor Core Isolation Cooling System component groups.

<u>Carbon Steel Turbine Lube Oil Reservoirs with Internal Coatings Exposed to Lubricating Oil</u>. In LRA Table 3.2.2-3, the applicant states that carbon steel turbine lube oil reservoirs with internal coatings exposed to lubricating oil will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. The AMR item cites generic note H.

The staff noted that this material and environment combination is identified in LR-ISG-2013-01, “Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.” LR-ISG-2013-01 Table 3.2-1, item 3.2.1-72, states that loss of coatings integrity for metallic piping, piping components, heat exchangers, and tanks with internal coatings/linings exposed to lubricating oil is managed by GALL Report AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.” The staff noted that given that LR-ISG-2013-01 was in a draft versus final status when the LRA was developed, the applicant chose to develop a plant-specific program to manage loss of coating integrity.

The staff’s evaluation of the applicant’s Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program is documented in SER Section 3.0.3.3.1. The staff finds the applicant’s proposal to manage loss of coating integrity using the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program acceptable because the program includes periodic visual inspections capable of detecting loss of coating integrity by qualified individuals.

Copper Alloy Heat Exchanger Tubes Internally Exposed to Treated Water. In LRA Table 3.2.2-3, the applicant stated that copper alloy with 15-percent zinc or more internally exposed to treated water will be managed for cracking by the Water Chemistry program. The AMR item cites generic note H, and plant-specific note 7, which states that aging effects for copper alloy with 15-percent zinc or more in a treated water environment include cracking. The One-Time Inspection and Water Chemistry programs are used to manage cracking for copper alloy with 15-percent zinc or more in a treated water environment.

The staff noted that this material and environment combination is identified in the GALL Report, which states that copper alloy with 15-percent zinc or more exposed to treated water is susceptible to selective leaching and recommends GALL Report AMP XI.M33, “Selective Leaching,” to manage the aging effect. However, the applicant has identified cracking as an additional aging effect. The applicant addressed the GALL Report-identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.2.2-3.

The staff’s evaluation of the applicant’s Water Chemistry and One-Time Inspection programs is documented in SER Sections 3.0.3.2.1 and 3.0.3.1.9, respectively. The staff finds the applicant’s proposal to manage the effects of aging using the Water Chemistry program acceptable because the program consists of periodic monitoring of the treated water to control known detrimental contaminants, such as chlorides, dissolved oxygen, and sulfate concentrations, so that they remain below the levels known to result in loss of material or cracking. The staff noted that the One-Time Inspection program will be used to verify the system-wide effectiveness of the Water Chemistry program by inspections focusing on locations that are isolated from the flow stream, that are stagnant, or that have low flow for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. Additionally, the One-Time Inspection program verifies either that unacceptable degradation is not occurring or triggers additional actions that will ensure that the intended function of affected components will be maintained during the period of extended operation.

Stainless Steel Piping, Piping Components, and Piping Elements Exposed to Soil. In LRA Table 3.2.2-3, the applicant stated that stainless steel piping, piping components, and piping elements exposed to soil will be managed for cracking by the Buried and Underground Piping program. The AMR item cites generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which states that stainless steel piping, piping components, and piping elements exposed to soil are susceptible to loss of material due to pitting and crevice corrosion and recommends GALL Report AMP XI.M41 to manage the aging effect. However, the applicant has cracking as an additional aging effect. The applicant addressed the aging effects identified in the GALL Report for this component, material, and environment combination in other AMR items in LRA Table 3.2.2-3.

The staff's evaluation of the applicant's Buried and Underground Piping program is documented in SER Section 3.0.3.2.14. The staff finds the applicant's proposal to manage cracking using the Buried and Underground Piping program acceptable because the program includes periodic visual inspections capable of detecting cracking in buried stainless steel piping.

Zinc Piping, Piping Components, and Piping Elements Exposed to Uncontrolled Indoor Air. The staff's evaluation for zinc piping, piping components, and piping elements exposed to uncontrolled indoor air, which will be managed by the External Surfaces Monitoring of Mechanical Components program and is associated with generic note F, is documented in SER Section 3.2.2.3.1.

Zinc Piping, Piping Components, and Piping Elements Exposed to Lubricating Oil. The staff's evaluation of zinc piping, piping components, and piping elements exposed to lubricating oil, which will be managed for loss of material by the Lubricating Oil Analysis and One-Time Inspection programs and is associated with generic note F, is documented in SER Section 3.2.2.3.1.

3.2.2.3.4 Residual Heat Removal System – of Aging Management Evaluation – LRA Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the Residual Heat Removal System component groups.

Nickel Alloy Flow Device Exposed to Treated Water. In LRA Table 3.2.2-4, the applicant stated that the nickel alloy flow device internally exposed to treated water will be managed for loss of material by the Water Chemistry program. The AMR items cite generic note G, and plant-specific note 3, which states that the Water Chemistry (LRA Section B.2.1.2) program and One-Time Inspection (LRA Section B.2.1.21) program are used to manage the aging effect(s) applicable to this component type, material, and environment combination.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff reviewed ASM *Specialty Handbook – Nickel, Cobalt, and Their Alloys*, dated December 2000, which states that nickel alloys, such as alloy 600 from which the elements are constructed, are "highly resistant to general corrosion and stress corrosion cracking but can be attacked at high caustic concentrations and temperatures." In addition, SCC has also been found to occur in environments with elevated levels of halides and sulfur species. As documented in SER Section 3.0.3.2.1, the staff found that the applicant's Water Chemistry program includes periodic monitoring of the treated water and control of known detrimental contaminants in accordance with EPRI 3002002623, "BWR Water Chemistry

Guidelines," Revision 1. These guidelines include the monitoring of chlorides, fluorides, sulfates, and sodium (as an indicator for the presence of (caustic) sodium hydroxide). During the audit, the staff verified that the applicant monitors these parameters periodically. Therefore, cracking is not a likely aging effect. The staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluations of the applicant's Water Chemistry and One-Time Inspection programs are documented in SER Sections 3.0.3.2.1 and 3.0.3.1.9, respectively. The applicant's Water Chemistry program manages loss of material, cracking, and reduction in heat transfer in components exposed to a treated water environment through periodic monitoring and control of water chemistry. The One-Time Inspection program performs focused inspections of components susceptible to certain aging effects to verify the effectiveness of the water chemistry controls. The staff finds the applicant's proposal to manage loss of material using the Water Chemistry and One-Time Inspection programs acceptable because maintaining proper primary water chemistry will control certain parameters known to contribute to corrosion and because a one-time inspection of components in low flow and stagnant areas will confirm the effectiveness of the Water Chemistry program (i.e., that age-related degradation is not occurring).

3.2.2.3.5 Standby Gas Treatment System – Summary of Aging Management Evaluation – LRA Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the Standby Gas Treatment System component groups.

Elastomers (Flexible Connections) Exposed to Condensation. In LRA Table 3.2.2-5, the applicant stated that elastomers exposed to condensation will be managed for hardening, loss of strength, and loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which states that elastomers exposed to condensation are susceptible to hardening, loss of strength, and loss of material, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.13. 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 opportunistic visual inspections conducted by the program, with a representative sample of components periodically inspected, are capable of detecting hardening, loss of strength, and loss of material in elastomers by observing for cracking, other surface discontinuities, and discoloration.

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 of the following:

- Closed-Cycle Cooling Water System
- Combustible Gas Control System
- Compressed Air System
- Control Rod Drive System
- Control Room Ventilation System
- Cranes, Hoists, and Refueling Equipment System
- Demineralized Water Makeup System
- Diesel Generator and Auxiliaries System
- Drywell Pneumatic System
- Electrical Penetration Pressurization System
- Essential Cooling Water System
- Fire Protection System
- Fuel Pool Cooling and Storage System
- Nonessential Cooling Water System
- Nonsafety-Related Ventilation System
- Plant Drainage System
- Primary Containment Ventilation System
- Process Radiation Monitoring System
- Process Sampling and Post-Accident Monitoring System
- Radwaste System
- Reactor Water Cleanup System
- Safety-Related Ventilation System
- Standby Liquid Control System
- Suppression Pool Cleanup System
- Traversing Incore Probe System

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 Aging Management Evaluations for the Auxiliary Systems," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary systems components.

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 the applicant's AMRs to verify the applicant's claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.3-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or require no aging management are noted in Table 3.3-1 and discussed in SER Section 3.3.2.1.1. Details of the staff's evaluation of AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information, are documented in SER Sections 3.3.2.1.2 through 3.3.2.1.9.

During its review, the staff also reviewed AMRs that are consistent with the GALL Report and those 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 evaluations of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with or are 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 of AMRs that are not consistent with, or are not addressed in, the GALL Report are documented in SER Section 3.3.2.3.

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 Systems Components in the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel Cranes: structural girders exposed to Air – indoor, uncontrolled (external) (3.3.1-1)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54 (Standard Review Plan, Section 4.7, "Other Plant-Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1))	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.3.2.2.1)
Stainless steel, steel heat exchanger components and tubes, piping, piping components, and piping elements exposed to treated borated water, air - indoor, uncontrolled, treated water (3.3.1-2)	Cumulative fatigue damage due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.3.2.2.1)
Stainless steel heat exchanger components, non-regenerative exposed to treated borated water >60°C (>140°F) (3.3.1-3)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.2.2)
Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor (3.3.1-4)	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.3.2.2.3)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel (with stainless steel or nickel-alloy cladding) pump casings exposed to treated borated water (3.3.1-5)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	Yes	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.2.4)
Stainless steel piping, piping components, and piping elements; tanks exposed to air–outdoor (3.3.1-6)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.3.2.2.5)
Stainless steel high-pressure pump, casing exposed to treated borated water (3.3.1-7)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
stainless steel heat exchanger components and tubes exposed to treated borated water >60°C (>140°F) (3.3.1-8)	Cracking due to cyclic loading	Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
Steel, aluminum, copper alloy (>15% Zn or >8% Al) external surfaces, piping, piping components, and piping elements, bolting exposed to air with borated water leakage (3.3.1-9)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
Steel, high-strength closure bolting exposed to air with steam or water leakage (3.3.1-10)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel, high-strength high-pressure pump, closure bolting exposed to air with steam or water leakage (3.3.1-11)	Cracking due to stress corrosion cracking; cyclic loading	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel; stainless steel closure bolting, bolting exposed to condensation, air – indoor, uncontrolled (external), air – outdoor (external) (3.3.1-12)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, “Bolting Integrity”	No	Bolting Integrity	Consistent with the GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.3.1-13)	Loss of material due to general corrosion	Chapter XI.M18, “Bolting Integrity”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel, stainless steel bolting exposed to soil (3.3.1-14)	Loss of preload	Chapter XI.M18, “Bolting Integrity”	No	Bolting Integrity	Consistent with the GALL Report
Steel; stainless steel, copper alloy, nickel alloy, stainless steel closure bolting, bolting exposed to air – indoor, uncontrolled (external), any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water (3.3.1-15)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, “Bolting Integrity”	No	Bolting Integrity	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F) (3.3.1-16)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M25, “BWR Reactor Water Cleanup System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water, treated borated water (3.3.1-17)	Reduction of heat transfer due to fouling	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel high-pressure pump, casing, piping, piping components, and piping elements exposed to treated borated water >60°C (>140°F), sodium pentaborate solution >60°C (>140°F) (3.3.1-18)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel regenerative heat exchanger components exposed to treated water >60°C (>140°F) (3.3.1-19)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel, stainless steel; steel with stainless steel cladding heat exchanger components exposed to treated borated water >60°C (>140°F), treated water >60°C (>140°F) (3.3.1-20)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-21)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements exposed to treated water (3.3.1-22)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-23)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Aluminum Piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, stainless steel; steel with stainless steel cladding, aluminum piping, piping components, and piping elements, heat exchanger components exposed to treated water, sodium pentaborate solution (3.3.1-25)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.3.2.1.2)
Steel with stainless steel cladding) piping, piping components, and piping elements exposed to treated water (3.3.1-26)	Loss of material due to pitting and crevice corrosion (only after cladding degradation)	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water (3.3.1-27)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements; tanks exposed treated borated water (primary, oxygen levels controlled) >60°C (>140°F) (3.3.1-28)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
Steel (with stainless steel cladding); stainless steel piping, piping components, and piping elements exposed to treated borated water (primary, oxygen levels controlled) (3.3.1-29)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to raw water (3.3.1-30)	Changes in material properties due to aggressive chemical attack	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Fiberglass, HDPE piping, piping components, and piping elements exposed to raw water (internal) (3.3.1-30x)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Concrete; cementitious material Piping, piping components, and piping elements exposed to raw water (3.3.1-31)	Cracking due to settling	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to raw water (3.3.1-32)	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Elastomer seals and components exposed to raw water (3.3.1-32x)	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to raw water (3.3.1-33)	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Nickel alloy, copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-34)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-35)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M20, “Open-Cycle Cooling Water System”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-36)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-37)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report
Copper alloy, steel heat exchanger components exposed to raw water (3.3.1-38)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-39)	Loss of material due to pitting and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-40)	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report (see SER Section 3.3.2.1.3)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-41)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report (see SER Section 3.3.2.1.4)
Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water (3.3.1-42)	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel Piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F) (3.3.1-43)	Cracking due to stress corrosion cracking	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water >60°C (>140°F) (3.3.1-44)	Cracking due to stress corrosion cracking	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report
Steel Piping, piping components, and piping elements; tanks exposed to closed-cycle cooling water (3.3.1-45)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report
Steel, copper alloy heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water (3.3.1-46)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water (3.3.1-47)	Loss of material due to microbiologically-influenced corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Aluminum piping, piping components, and piping elements exposed to closed-cycle cooling water (3.3.1-48)	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water (3.3.1-49)	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, copper alloy, steel heat exchanger tubes exposed to closed-cycle cooling water (3.3.1-50)	Reduction of heat transfer due to fouling	Chapter XI.M21A, “Closed Treated Water Systems”	No	Closed Treated Water Systems	Consistent with the GALL Report
Boraflex™ spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water (3.3.1-51)	Reduction of neutron-absorbing capacity due to Boraflex™ degradation	Chapter XI.M22, “Boraflex Monitoring”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel Cranes: rails and structural girders exposed to air – indoor, uncontrolled (external) (3.3.1-52)	Loss of material due to general corrosion	Chapter XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems”	No	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Consistent with the GALL Report
Steel Cranes - rails exposed to air – indoor, uncontrolled (external) (3.3.1-53)	Loss of material due to wear	Chapter XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems”	No	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements exposed to condensation (3.3.1-54)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M24, “Compressed Air Monitoring”	No	Compressed Air Monitoring	Consistent with the GALL Report
Steel Piping, piping components, and piping elements: compressed air system exposed to condensation (internal) (3.3.1-55)	Loss of material due to general and pitting corrosion	Chapter XI.M24, “Compressed Air Monitoring”	No	Compressed Air Monitoring An exception applies to the Compressed Air Monitoring program	Consistent with the GALL Report
Stainless steel Piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-56)	Loss of material due to pitting and crevice corrosion	Chapter XI.M24, “Compressed Air Monitoring”	No	Compressed Air Monitoring An exception applies to the Compressed Air Monitoring program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomers fire barrier penetration seals exposed to air-indoor, uncontrolled, air – outdoor (3.3.1-57)	Increased hardness; shrinkage; loss of strength due to weathering	Chapter XI.M26, "Fire Protection"	No	Fire Protection	Consistent with the GALL Report
Steel halon/carbon dioxide fire suppression system piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) (3.3.1-58)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M26, "Fire Protection"	No	Fire Protection	Consistent with the GALL Report
Steel fire rated doors exposed to air - indoor, uncontrolled, air – outdoor (3.3.1-59)	Loss of material due to wear	Chapter XI.M26, "Fire Protection"	No	Fire Protection	Consistent with the GALL Report
Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled (3.3.1-60)	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Fire Protection, and Structures Monitoring	Consistent with the GALL Report
Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air – outdoor (3.3.1-61)	Cracking, loss of material due to freeze-thaw, aggressive chemical attack, and reaction with aggregates	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Fire Protection, and Structures Monitoring	Consistent with the GALL Report
Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled, air – outdoor (3.3.1-62)	Loss of material due to corrosion of embedded steel	Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring"	No	Fire Protection, and Structures Monitoring	Consistent with the GALL Report
Steel fire hydrants exposed to air – outdoor (3.3.1-63)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M27, "Fire Water System"	No	Fire Water System Exceptions apply to the Fire Water System program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-64)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Fire Water System, and Bolting Integrity Exceptions apply to the Fire Water System program	Consistent with the GALL Report (see SER Section 3.3.2.1.5)
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-65)	Loss of material due to pitting and crevice corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Open-Cycle Cooling Water System	Consistent with the GALL Report (see SER Section 3.3.2.1.6)
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-66)	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, "Fire Water System"	No	Fire Water System Exceptions apply to the Fire Water System program	Consistent with the GALL Report
Steel tanks exposed to air – outdoor (external) (3.3.1-67)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-68)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-69)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Fuel Oil Chemistry, and One-Time Inspection	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements; tanks exposed to fuel oil (3.3.1-70)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Fuel Oil Chemistry, and One-Time Inspection	Consistent with the GALL Report
Stainless steel, aluminum piping, piping components, and piping elements exposed to fuel oil (3.3.1-71)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M30, "Fuel Oil Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Fuel Oil Chemistry, and One-Time Inspection	Consistent with the GALL Report
Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to treated water, closed-cycle cooling water, soil, raw water, waste water (3.3.1-72)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Selective Leaching	Consistent with the GALL Report
Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor (3.3.1-73)	Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor (3.3.1-74)	Cracking due to settling	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to air – outdoor (3.3.1-75)	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (internal/external) (3.3.1-76)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor (3.3.1-77)	Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel piping and components (external surfaces), ducting and components (external surfaces), ducting; closure bolting exposed to air – indoor, uncontrolled (external), air – indoor, uncontrolled (external), air – outdoor (external), condensation (external) (3.3.1-78)	Loss of material due to general corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	External Surfaces Monitoring of Mechanical Components, and Fire Protection	Consistent with the GALL Report (see SER Section 3.3.2.1.7)
Copper alloy piping, piping components, and piping elements exposed to condensation (external) (3.3.1-79)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air – outdoor (external) (3.3.1-80)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Copper alloy, aluminum piping, piping components, and piping elements exposed to air – outdoor (external), air – outdoor (3.3.1-81)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (external) (3.3.1-82)	Loss of material due to wear	Chapter XI.M36, “External Surfaces Monitoring of Mechanical Components”	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Stainless steel Diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-83)	Cracking due to stress corrosion cracking	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Elastomers elastomer seals and components exposed to closed-cycle cooling water (3.3.1-85)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Elastomers, linings, elastomer: seals and components exposed to treated borated water, treated water, raw water (3.3.1-86)	Hardening and loss of strength due to elastomer degradation	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
The SRP-LR, as amended by ISGs, does not list an Item No. (3.3.1-87)	N/A	N/A	N/A	N/A	N/A
Steel; stainless steel piping, piping components, and piping elements, piping, piping components, and piping elements, diesel engine exhaust exposed to raw water (potable), diesel exhaust (3.3.1-88)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Steel, copper alloy piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-89)	Loss of material due to general, pitting, and crevice corrosion	For fire water system components: Chapter XI.M27, “Fire Water System,” or for other components: Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel ducting and components (internal surfaces) exposed to condensation (internal) (3.3.1-90)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically -influenced corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report (see SER Section 3.3.2.1.8)
Steel piping, piping components, and piping elements; tanks exposed to waste water (3.3.1-91)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-92)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements exposed to raw water (potable) (3.3.1-93)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel ducting and components exposed to condensation (3.3.1-94)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Copper alloy, stainless steel, nickel alloy, steel piping, piping components, and piping elements, heat exchanger components, piping, piping components, and piping elements; tanks exposed to waste water, condensation (internal) (3.3.1-95)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Elastomer: seals and components exposed to air – indoor, uncontrolled (internal) (3.3.1-96)	Loss of material due to wear	Chapter XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements, reactor coolant pump oil collection system: tanks, reactor coolant pump oil collection system: piping, tubing, valve bodies exposed to lubricating oil (3.3.1-97)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Lubricating Oil Analysis, and One-Time Inspection	Consistent with the GALL Report
Steel heat exchanger components exposed to lubricating oil (3.3.1-98)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Lubricating Oil Analysis, and One-Time Inspection	Consistent with the GALL Report
Copper alloy, aluminum piping, piping components, and piping elements exposed to lubricating oil (3.3.1-99)	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Lubricating Oil Analysis, and One-Time Inspection	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-100)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Lubricating Oil Analysis, and One-Time Inspection	Consistent with the GALL Report
Aluminum heat exchanger tubes exposed to lubricating oil (3.3.1-101)	Reduction of heat transfer due to fouling	Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection"	No	Lubricating Oil Analysis, and One-Time Inspection	Consistent with the GALL Report
Boral®; boron steel, and other materials (excluding Boraflex™) spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water (3.3.1-102)	Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment	Chapter XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex"	No	Monitoring of Neutron-Absorbing Materials Other Than Boraflex	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to soil or concrete (3.3.1-103)	Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
HDPE, fiberglass piping, piping components, and piping elements exposed to soil or concrete (3.3.1-104)	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Concrete cylinder piping, asbestos cement pipe piping, piping components, and piping elements exposed to soil or concrete (3.3.1-105)	Cracking, spalling, corrosion of rebar due to exposure of rebar	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete (3.3.1-106)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping	Consistent with the GALL Report
Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete (3.3.1-107)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, and piping elements, bolting exposed to soil or concrete (3.3.1-108)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel bolting exposed to soil or concrete (3.3.1-109)	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Underground aluminum, copper alloy, stainless steel, nickel alloy steel piping, piping components, and piping elements (3.3.1-109x)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F) (3.3.1-110)	Cracking due to stress corrosion cracking	Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel structural steel exposed to air – indoor, uncontrolled (external) (3.3.1-111)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to concrete (3.3.1-112)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Consistent with the GALL Report	Consistent with the GALL Report (see SER Section 3.3.2.1.9)
Aluminum piping, piping components, and piping elements exposed to air – dry (internal/external), air – indoor, uncontrolled (internal/external), air – indoor, controlled (external), gas (3.3.1-113)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – dry, gas (3.3.1-114)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy (≤15% Zn and ≤8% Al) piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-115)	None	None	NA - No AEM or AMP	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.3.2.1.1)
Galvanized steel piping, piping components, and piping elements exposed to air - indoor, uncontrolled (3.3.1-116)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Glass Piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, closed-cycle cooling water, air – outdoor, fuel oil, raw water, treated water, treated borated water, air with borated water leakage, condensation (internal/external) gas (3.3.1-117)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) (3.3.1-118)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Nickel alloy, PVC, glass piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal), waste water (3.3.1-119)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report (see SER Section 3.3.2.1.9)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – indoor, uncontrolled (external), air with borated water leakage, concrete, air – dry, gas (3.3.1-120)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report (see SER Section 3.3.2.1.9)
Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), air – dry, gas (3.3.1-121)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Titanium heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled or air – outdoor (3.3.1-122)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) heat exchanger components other than tubes, piping, piping components, and piping elements exposed to raw water (3.3.1-123)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water >60°C (>140°F), treated borated water >60°C (>140°F) (3.3.1-124)	Cracking due to stress corrosion cracking	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel (with stainless steel cladding); stainless steel spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements exposed to treated water, treated borated water (3.3.1-125)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Chapter XI.M32, “One-Time Inspection”	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated), raw water (3.3.1-126)	Wall thinning due to erosion	Chapter XI.M17, “Flow-Accelerated Corrosion”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Metallic piping, piping components, and tanks exposed to raw water or waste water (3.3.1-127)	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific	Open-Cycle Cooling Water System, Fire Water System, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report (see SER Section 3.3.2.2.8)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, “Aboveground Metallic Tanks”) exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.3.1-128)	Loss of material due to general (steel only), pitting, or crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, condensation (3.3.1-129)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, “Aboveground Metallic Tanks”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Metallic sprinklers exposed to air-indoor controlled, air-indoor uncontrolled, air-outdoor, moist air, condensation, raw water, treated water (3.3.1-130)	Loss of material due to general (where applicable), pitting, crevice, and microbiologically -influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, “Fire Water System”		Fire Water System Exceptions apply to the Fire Water System program	Consistent with the GALL Report
Steel, stainless steel, copper alloy, or aluminum fire water system piping, piping components and piping elements exposed to air-indoor uncontrolled (internal), air-outdoor(internal), or condensation (internal) (3.3.1-131)	Loss of material due to general (steel, and copper alloy only), pitting, crevice, and microbiologically -influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling	Chapter XI.M27, “Fire Water System”	No	Fire Water System Exceptions apply to the Fire Water System program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor (3.3.1-132)	Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Underground HDPE piping, piping components, and piping elements in an air-indoor uncontrolled or condensation (external) environment (3.3.1-133)	Cracking, blistering, change in color due to water absorption	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel, stainless steel, or copper alloy piping, piping components, and piping elements, and heat exchanger components exposed to a raw water environment (for nonsafety-related components not covered by NRC GL 89-13) (3.3.1-134)	Loss of material due to general (steel and copper alloy only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion	Chapter XI.MI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel or stainless steel pump casings submerged in a waste water (internal and external) environment (3.3.1-135)	Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion	Chapter XI.MI.M36, "External Surfaces Monitoring of Mechanical Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel or aluminum fire water storage tanks exposed to air-indoor uncontrolled, air-outdoor, condensation, moist air, raw water, treated water (3.3.1-136)	Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M27, "Fire Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water (3.3.1-137)	Loss of material due to general (steel only) pitting and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.3.2.1.1)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, or fuel oil (3.3.1-138)	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not Used	Not used by LSCS (see SER Section 3.3.2.3.7)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.3.1-139)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not Used	Not Used (see SER Section 3.3.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water (3.3.1-140)	Loss of material due to selective leaching	Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	No	Not Used	Not Used (see SER Section 3.3.2.1.1)

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:

- Bolting Integrity
- Buried and Underground Piping
- Closed Treated Water Systems
- Compressed Air Monitoring
- External Surfaces Monitoring of Mechanical Components
- Fire Protection
- Fire Water System
- Flow-Accelerated Corrosion
- Fuel Oil Chemistry
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Lubricating Oil Analysis
- Monitoring of Neutron-Absorbing Materials Other Than Boraflex
- One-Time Inspection
- Open-Cycle Cooling Water System
- Selective Leaching
- Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program
- Structures Monitoring
- TLAA
- Water Chemistry

LRA Tables 3.3.2-1 through 3.3.2-25 summarize the AMR results for the auxiliary system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report for those items that the staff determined were bounded by the GALL Report evaluation. However, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.3.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.3.1, items 3.3.1-7 through3.3.1-9, 3.3.1-28, 3.3.1-29, and 3.3.1-115, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.3.1, items 3.3.1-10, 3.3.1-11, 3.3.1-17 through 3.3.1-18, 3.3.1-23, 3.3.1-24, 3.3.1-26, 3.3.1-30 through 3.3.1-35, 3.3.1-39, 3.3.1-48, 3.3.1-51, 3.3.1-67, 3.3.1-73 through 3.3.1-75, 3.3.1-77, 3.3.1-81, 3.3.1-85, 3.3.1-86, 3.3.1-93, 3.3.1-96, 3.3.1-103 through 3.3.1-105, 3.3.1-107, 3.3.1-108, 3.3.1-109x, 3.3.1-111, 3.3.1-122 through 3.3.1-124, 3.3.1-128, 3.3.1-129, and 3.3.1-133 through 3.3.1-137, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

SER Table 3.3-1, items 3.3.1-139 and 3.3.1-140, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers and Tanks." The ISG added these items to manage loss of coating integrity and to allow applicants to credit the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. Because the final ISG was issued only shortly before the LRA was submitted, the applicant did not cite SRP-LR items 3.3.1-139 and 3.3.1-140 in the LRA. The staff finds the applicant's proposal to not use SRP-LR items 3.3.1-139 and 3.3.1-140 acceptable because they used other programs to manage loss of material, such as the following: (a) loss of material of the galvanized steel fire water system piping and piping components is managed by the Fire Water System program, and (b) loss of material for the copper greater than 15-percent zinc diesel generator cooler heat exchanger tube sheet is managed by the Open-Cycle Cooling Water System and Selective Leaching programs. This approach is consistent with GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks."

For the LRA Table 3.3.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable. For these items, the staff reviewed sources beyond the LRA and UFSAR or issued one or more RAIs, or both, in order to verify the applicant's claim of non-applicability.

LRA Table 3.3.1, item 3.3.1-13, addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends GALL Report 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 there is no steel closure bolting exposed to air with steam or water leakage in the auxiliary systems. The staff evaluated the applicant's claim and notes that the possibility for the steel closure bolts in the auxiliary systems to be exposed to an air with steam or water leakage environment during the period of extended operation cannot be eliminated. However, the staff finds that the steel closure bolts in the auxiliary systems will be adequately age managed for loss of material due to general corrosion and finds the non-applicability of LRA item 3.3.1-13 acceptable because of the following:

- Through LRA Table 3.3.1, items 3.3.1-12 and 3.3.1-78, the applicant will use the Bolting Integrity and External Surfaces Monitoring of Mechanical Components programs to manage loss of material of all closure bolting in the auxiliary systems.
- Both programs conduct periodic visual inspections, which are capable of detecting loss of material due to general corrosion in closure bolting.
- Use of these programs is consistent with the GALL Report.

LRA Table 3.3.1, item 3.3.1-16, addresses stainless steel piping exposed to treated water greater than 60 °C (140 °F). The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and AMP XI.M25, "BWR Reactor Water Cleanup System," to manage cracking due to SCC for this component group. The applicant stated that this item is not applicable because there is no stainless steel piping greater than or equal to NPS 4-inches exposed to treated water greater than 60 °C (140 °F). The staff notes that GALL Report AMP XI.M25 addresses cracking as delineated in GL 88-01, "NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, and only applies to stainless steel piping greater than or equal to NPS 4-inches. The staff evaluated the applicant's claim and finds it acceptable because piping greater than or equal to NPS 4-inches in the reactor water cleanup system was confirmed to be carbon steel.

LRA Table 3.3.1, item 3.3.1-47, addresses stainless steel heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends GALL Report AMP XI.M21A, "Closed Treated Water Systems," to manage loss of material due to microbiologically-influenced corrosion for this component group. The applicant stated that this item is not applicable because microbiologically-influenced corrosion is not a predicted aging mechanism for loss of material in the closed-cycle cooling water environment. The applicant also stated that stainless steel heat exchanger components exposed to closed-cycle cooling water are being managed for loss of material through item 3.3.1-49. The staff notes that the later AMR item manages loss of material due to pitting and crevice corrosion but does not include microbiologically-influenced corrosion.

The staff evaluated the applicant's claim and notes that, although LRA item 3.3.1-47 states that microbiologically-influenced corrosion is not a predicted aging mechanism in this environment, the operating experience discussion in LRA Section B.2.1.13, "Closed-Cycle Cooling Water Systems," recounts an issue whereby the primary containment chilled water system experienced chemistry parameter changes indicative of microbiological growth in the closed treated water. The discussion included corrective actions taken by the applicant to address this issue. In addition, the staff notes that, during its audit of the applicant's program, it verified that the program elements for the applicant's program were consistent with the corresponding program elements in GALL Report AMP XI.M21A and that the appropriate program elements included microbiological testing. Based on the above, the staff discounts the applicant's statement for item 3.3.1-47 related to microbiologically-influenced corrosion not being a predicted aging mechanism because the applicant's Closed Treated Water Systems program clearly includes microbiological testing, consistent with GALL Report AMP XI.M21A. In addition, as demonstrated by the program's operating experience discussion, microbiological activity has been identified in closed-cycle cooling water environment. Because the program currently includes microbiological testing, the use of AMR item 3.3.1-49 is acceptable for managing loss of material due to pitting and crevice corrosion for stainless steel heat exchanger components exposed to closed-cycle cooling water.

LRA Table 3.3.1, item 3.3.1-68 addresses steel piping, piping components, and piping elements exposed to fuel oil. The GALL Report recommends GALL Report AMP XI.M30, “Fuel Oil Chemistry,” and AMP XI.M32, “One-Time Inspection,” to manage loss of material due to general, pitting, and crevice corrosion. The applicant stated that this item is not applicable because loss of material in carbon steel piping, piping components, and piping elements exposed to fuel oil is addressed in LRA Table 3.3.1, item 3.3.1-70. The staff evaluated the applicant’s claim and finds it acceptable because carbon steel piping, piping components, and piping elements exposed to fuel oil is being manage for loss of material using the above GALL Report recommendation in LRA Table 3.3.1, item 3.3.1-70.

LRA Table 3.3.1, item 3.3.1-79, addresses copper-alloy piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to manage loss of material for this component group. The applicant stated that this item is not applicable because the component group is addressed in LRA Table 3.3.1, item 3.3.1-89. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will be used to manage loss of material for copper-alloy heat exchanger tubes during heat exchanger internal inspections because the copper components are heat exchanger tubes located within heating, ventilation, and air conditioning ducting. The staff finds the applicant’s proposal to manage loss of material using the Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the program includes periodic external visual inspections of the tubing capable of detecting loss of material for copper-alloy piping, piping components, and piping elements.

LRA Table 3.3.1, item 3.3.1-110, addresses stainless steel piping, piping components, and piping elements exposed to treated water greater than 60 °C (140 °F). The GALL Report recommends GALL Report AMP XI.M7, “BWR Stress Corrosion Cracking,” and AMP XI.M2, “Water Chemistry,” to manage cracking due to SCC for these components. The applicant indicated that this item is not applicable because (1) the BWR Stress Corrosion Cracking program manages crack initiation and growth in Reactor Coolant Pressure Boundary System piping, piping components, and piping elements equal to, or greater than, NPS 4-inches and (2) a different AMR item (LRA item 3.3.1-19) addresses cracking in stainless steel piping, piping components, and piping elements less than NPS 4-inches, which are exposed to treated water greater than 140 °F in the auxiliary systems.

In its review, the staff noted that the following reference with its Enclosure 1 indicates that the applicant’s BWR Stress Corrosion Cracking program, which is based on GL 88-01, includes ASME Code Class 1, 2, and 3 piping made of stainless steel that contains reactor coolant at a temperature above 200 °F during power operation.

During its review, the staff noted that applicant’s response to GL 88-01, dated July 29, 1988, which provides the basis for the applicant’s BWR Stress Corrosion Cracking program, includes piping welds located in the reactor water cleanup system. The staff also noted that LRA Section 3.3.1 indicates that the reactor water cleanup system is included in the auxiliary systems. However, the staff noted that LRA item 3.3.1-110 and Table 3.3.2-21 (the AMR table for the reactor water cleanup system) do not identify the piping welds that are included in the applicant’s program as described in the reference document above.

By letter dated July 7, 2015, the staff issued RAI 3.3.1.110-1, requesting that the applicant clarify why LRA item 3.3.1-110 and Table 3.3.2-21 do not identify the reactor water cleanup system piping welds that are included in the program as described in the reference document above. The staff also requested that the applicant add relevant AMR items to manage cracking due to SCC for these components if these welds are within the scope of the program.

In its response dated August 6, 2015, the applicant stated that the stainless steel portion of the plant reactor water cleanup system that is included in the scope of the BWR Stress Corrosion Cracking program is the ASME Code Class 1 portion of the system. The applicant also stated that this piping is identified as piping design class A949LS on license renewal boundary drawings LR-LAS-M-97, sheet 1 (LSCS, Unit 1), and LR-LAS-M-143, sheet 1 (LSCS, Unit 2), at drawing coordinate B-8. The applicant further stated that, as discussed in LRA Section 2.3.1.1, "Reactor Coolant Pressure Boundary System," and LRA Section 2.3.3.21, "Reactor Water Cleanup System," this portion of the LSCS, Units 1 and 2, reactor water cleanup system is scoped with the Reactor Coolant Pressure Boundary System. In addition, the applicant indicated that the ASME Code Class 1 piping, piping components and piping elements are not identified in LRA Table 3.3.2-21 for the reactor water cleanup system; instead, they are identified in LRA Table 3.1.2-1 as pressure boundary stainless steel piping, piping components, and piping elements (Table 1, item 3.1.1-97).

In its review, the staff finds the applicant's response acceptable because the applicant clarified that (1) the reactor water cleanup system piping and associated welds identified within the scope of the applicant's program are part of the reactor coolant pressure boundary and (2) the applicant's AMR of SCC for these components is included in AMR item 3.1.1-97 as described in LRA Table 3.1.2-1. The staff's concern described in RAI 3.3.1.110-1 is resolved.

For LRA Table 3.3.1, item 3.3.1-110, the applicant claimed that it is not applicable. The staff reviewed the LRA and the applicant's response to RAI 3.3.1.110-1 as discussed above and confirmed that LRA item 3.3.1-110 is not applicable because item 3.1.1-97 addresses cracking due to SCC for the stainless steel piping and welds in the reactor coolant pressure boundary.

LRA Table 3.3.1, item 3.3.1-126 addresses any material piping, piping components, and piping elements exposed to treated water, treated water (borated), or raw water. The GALL Report recommends GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," to manage wall thinning due to erosion for this component group. The applicant stated that this item is not applicable because there are no piping, piping components, and piping elements exposed to treated water, treated water (borated), or raw water susceptible to wall thinning due to erosion in auxiliary systems. The staff evaluated the applicant's claim and finds it acceptable because, during its audit, the staff searched the applicant's operating experience database and did not identify components in auxiliary systems that were experiencing wall thinning due to erosion.

3.3.2.1.2 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-25, addresses stainless steel and aluminum exposed to treated water (external), which will be managed for loss of material due to pitting and crevice corrosion. For the AMR item that cites generic note E, the LRA credits the Water Chemistry and Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems programs to manage the aging effect for aluminum crane/hoist in the fuel preparation machine. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M32 recommends using a visual inspection to manage the effects of aging.

The staff's evaluation of the applicant's Water Chemistry and Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems programs are documented in

SER Sections 3.0.3.2.1 and 3.0.3.2.7, respectively. The staff noted that GALL Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," recommends that the surface condition of cranes' structural components be monitored by visual inspection to ensure that loss of material is not occurring. GALL Report AMP XI.M23 also recommends that the visual inspections be performed at a frequency in accordance with ASME Code B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)," and with other appropriate standards in the ASME Code B30 series, or once every refueling cycle just before use for systems that are infrequently in service. The staff noted that the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program proposes to manage the effects of aging of loss of material for the aluminum crane and/or hoist through the use of periodic visual inspections. These periodic inspections are performed consistent with the appropriate ASME Code B30 series standard for all cranes, hoists, and handling equipment systems within the scope of license renewal. For the crane and hoist in the fuel preparation machine, periodic inspections are performed at least just before use during refueling outages. Based on its review of components associated with LRA Table 3.3.1, item 3.3.1-25, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable because (1) the applicant will perform periodic visual inspections at least just before use during refueling outages to detect loss of material on cranes and or hoists and (2) the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program is the GALL Report-recommended AMP to manage the aging effects of cranes and hoists structural components.

The staff concludes that, for LRA item 3.3.1-25, the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.1.3 Loss of Material Due to Pitting, Crevice Corrosion, and Fouling that Leads to Corrosion

During its review of components associated with LRA Table 3.3.1, item 3.3.1-40, for which the applicant cited generic note A, the staff noted that the LRA credits the Open-Cycle Cooling Water System program to manage loss of material for the stainless steel "fish barrier." The staff evaluated the components associated with this item during its AMP audit because fish barrier components were atypical for piping and piping components normally associated with this item. As documented in its Audit Report, the staff reviewed the System and Structure Screening Report for the Essential Cooling Water System and noted that the component type "fish barrier" includes the stainless steel buoy cylinders, cable, and wire cloth. The accompanying comment states that a shad net is installed in the lake screen house flume and that the polymeric portions of the shad net (netting, twine, and ty-wraps) are periodically replaced making them short lived and not subject to an AMR. Based on the discussion provided in the screening report for the associated components, the staff finds that periodic visual inspections performed by the Open-Cycle Cooling Water System program can adequately manage loss of material for the stainless steel components associated with the fish barrier.

The staff concludes that for LRA item 3.3.1-40, 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).

3.3.2.1.4 Loss of Material Due to Pitting, Crevice Corrosion, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-41, addresses stainless steel piping and piping components exposed to raw water, which will be managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion. For the AMR item that cites generic note E, the LRA credits the RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," program to manage the aging effect for the stainless steel concrete anchors in the Lake Screen House. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," program to ensure that this aging effect is adequately managed for loss of material due to corrosion and recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," program is documented in SER Section 3.0.3.2.20. The staff notes that the applicant's RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," program proposes to manage the effects of aging for stainless steel concrete anchors through the use of periodic visual inspections. Based on its review of components associated with item 3.3.1-41 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using its RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the proposed program manages other structural bolting components using periodic visual inspections and because these inspections are sufficient to detect loss of material before loss of function.

The staff concludes that, for LRA item 3.3.1-41, 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 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion; Fouling that Leads to Corrosion; and Flow Blockage Due to Fouling

LRA Table 3.3.1, item 3.3.1-64, addresses steel and copper-alloy piping, piping components, and piping elements exposed to raw water, which will be managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; and flow blockage due to fouling. For the AMR items that cite generic note E, the applicant stated that "[t]he Bolting Integrity (LRA Section B.2.1.11) program has been substituted and will be used to manage loss of material of carbon and low alloy steel bolting exposed to raw water in the Nonessential Cooling Water System and Fire Protection System." The staff noted that GALL Report AMP XI.M27 does not specifically address loss of material for bolting.

The staff's evaluation of the applicant's Bolting Integrity program is documented in SER Section 3.0.3.2.4. The staff noted that the Bolting Integrity program proposes to manage the effects of aging for carbon and low alloy steel bolting through the use of periodic inspections for indication of loss of preload, cracking, and loss of material due to corrosion. However, the applicant did not state the parameters, sample size, or frequency of inspections to be performed on submerged bolting for item 3.3.1-64, which addresses the diesel fire pump suction screens. By letter dated July 7, 2015, the staff issued RAI 3.2.2.1.1-1, requesting that the applicant (a) state and justify the parameters for inspections and state whether a representative sample will be removed and inspected and (b) justify the inspection frequency for submerged bolting, other than those associated with the lake screen house traveling screen framework for which they specified a frequency of once per refuel interval, which is consistent with GALL Report AMP XI.M18.

In its response to Part (a) of RAI 3.2.2.1.1-1, dated August 6, 2015, the applicant stated that the bolting on the ECCS and RCIC suction strainers, service water diver safety barriers, diesel fire pump suction screens, and the lake screen house traveling screens framework is submerged non-pressure-retaining bolting. The applicant also stated that the existing plant-specific inspection procedures would be enhanced so that 100 percent of the accessible surfaces of these submerged bolts will require inspection of the bolt heads, nuts, and threaded bolt shank beyond the nut by divers during each inspection. The applicant also stated that the plant-specific procedures would be further enhanced to require manipulation of the nuts to ensure that they are not loose. The applicant further stated that the geometry of the ECCS and RCIC strainer bolting is such that portions of the threaded shank beyond the nuts are visible; therefore, loss of material can be detected without the need to remove the nuts for inspection.

The applicant stated that, because of tight clearances, the bolt heads on the outside of traveling screens are not accessible; however, because these bolts and associated nuts are accessible on the inside of the framework and are exposed to the same environment, the inspections performed on the portions of the bolts and nuts inside the framework would be indicative of the condition of the inaccessible portions of the bolting.

The staff noted that the submerged bolting for LRA item 3.3.1-64 does not have a pressure boundary function; therefore, it is appropriate that certain aspects of GALL Report AMP XI.M18 would not be applicable to these bolts (i.e., testing for leakage). In its review, the staff also noted that GALL Report AMP XI.S6 recommends that structural bolting be monitored for loose bolts, missing or loose nuts, and other conditions indicative of loss of preload.

The staff finds the applicant’s response acceptable because the applicant enhanced its Bolting Integrity program to perform inspections on 100 percent of the accessible surfaces of the submerged bolting during each inspection. Performing these inspections provides reasonable assurance of the condition of the inaccessible bolting because, in all instances, the accessible and inaccessible bolting addressed by LRA item 3.3.1-64 would be exposed to the same environment. The staff’s concerns described in Part (a) of RAI 3.2.2.1.1-1 are resolved.

In its response to Part (b) of the RAI, the applicant stated that the program will be enhanced to require that all ECCS and RCIC suction strainer submerged bolting is inspected during each 10-year ISI interval. The applicant also stated that the program would be enhanced to perform the inspections of the service water diver safety barriers and diesel fire pump suction screen bolting during every refueling outage, consistent with the recommendations of GALL Report AMP XI.M18. The staff finds the applicant’s response acceptable because (a) inspection of all of the bolting for the ECCS and RCIC suction strainers every 10-year ISI interval would ensure that a representative sample of these bolts is examined during each ISI period and (b) the bolting for the service water diver safety and diesel fire pump suction screens will be inspected during every outage, consistent with the recommendations of GALL Report AMP XI.M18. The staff’s concerns described in Part (b) of RAI 3.2.2.1.1-1 are resolved.

The staff concludes that, for LRA item 3.3.1-64, 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).

3.3.2.1.6 Loss of Material Due to Pitting and Crevice Corrosion; Fouling that Leads to Corrosion; and Flow Blockage Due to Fouling

LRA Table 3.3.1, item 3.3.1-65, addresses aluminum piping, piping components, and piping elements exposed to raw water, which will be managed for loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; and flow blockage due to fouling. For the AMR items that cite generic note E, the LRA credits the Open-Cycle Cooling Water System program to manage the aging effects for aluminum piping, piping components, and piping elements. The GALL Report recommends GALL Report AMP XI.M27, “Fire Water System,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.M27 recommends using flow testing, other testing, and visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s Open-Cycle Cooling Water System program is documented in SER Section 3.0.3.2.5. The staff noted that the Open-Cycle Cooling Water System program proposes to manage the effects of aging for aluminum piping, piping components, and piping elements through the use of visual inspections or nondestructive examinations. Based on its review of components associated with item 3.3.1-65, all of which are located in the Nonessential Cooling Water System, for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the Open-Cycle Cooling Water System program acceptable because it will perform inspections comparable to the Fire Water System program, which are capable of detecting loss of material due to pitting and crevice corrosion, fouling that leads to corrosion, and flow blockage due to fouling before a loss of intended function.

The staff concludes that, for LRA item 3.3.1-65, 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).

3.3.2.1.7 Loss of Material Due to General Corrosion

LRA Table 3.3.1, item 3.3.1-78 addresses external surfaces of steel piping and components, ducting and components, ducting, and closure bolting exposed to uncontrolled air-indoor, air-outdoor, and condensation, which will be managed for loss of material due to general corrosion. The LRA credits the External Surfaces Monitoring of Mechanical Components program to manage the aging effect for external surfaces for steel piping and components, ducting and components, ducting, and closure bolting exposed to uncontrolled indoor air, outdoor air, and condensation. However, for the AMR items that cite generic note E in LRA Table 3.3.2-12 and plant-specific note 2, the LRA credits the Fire Protection program as a substitute to the “External Surfaces Monitoring of Mechanical Components” to manage the aging effect(s) for carbon steel and galvanized steel fire barriers (doors). The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to ensure that this aging effect is adequately managed. GALL Report AMP XI.M36 recommends using periodic visual inspections and walkdowns to manage the effects of aging of the external surfaces of metallic components.

The staff’s evaluations of the applicant’s External Surfaces Monitoring of Mechanical Components and Fire Protection programs are documented in SER Sections 3.0.3.1.12

and 3.0.3.2.9, respectively. The staff noted that the External Surfaces Monitoring of Mechanical Components program proposes to manage the effects of aging for metallic and elastomeric components (e.g., piping components and ducting) within the scope of license renewal through the use of visual inspections of external surfaces for evidence of loss of material, cracking, and changes in material properties. The External Surfaces Monitoring of Mechanical Components program states that the inspections to detect corrosion under insulation will be conducted during each 10-year period of the period of extended operation. Inspections, with the exception of inspections performed to detect corrosion under insulation, are performed at a frequency not to exceed one refueling cycle. The staff further noted that the Fire Protection program manages the aging effects, such as loss of material, on fire doors through visual inspections and functional testing at least once every refueling cycle (24 months). Based on its review of components associated with item 3.3.1-78 for which the applicant cited generic note E, plant-specific note 2, the staff finds the applicant's proposal to manage the effects of aging using the Fire Protection program acceptable because the applicant's program is consistent, with enhancements, with GALL Report AMP XI.M26, which recommends visual inspections of fire-rated doors to detect any degradation of door surfaces, and because the inspections will be conducted at the same frequency under the Fire Protection program (once every 2 years) compared to the inspection frequency under the External Surfaces Monitoring of Mechanical Components program.

The staff concludes that, for LRA Item 3.3.1-78, 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).

3.3.2.1.8 Loss of Material Due to General, Pitting, Crevice and (for Drip Pans and Drain Lines) Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-90 addresses the internal surfaces of steel ducting and components exposed to condensation, which will be managed for loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically-influences corrosion. The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effect for internal surfaces of steel ducting and components exposed to condensation. However, for the AMR items that cite generic note E and plant-specific note 10 in LRA Table 3.3.2-12, the LRA credits the Fire Protection program as a supplement to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effect(s) for galvanized steel fire barriers (damper housing) when exposed to condensation. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M38 recommends using periodic visual inspections to ensure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

The staff's evaluations of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components and Fire Protection programs are documented in SER Sections 3.0.3.1.13 and 3.0.3.2.9, respectively. The staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program proposes to manage the effects of aging for metallic components (e.g., piping components and piping elements) within the scope of license renewal through the use of visual inspections of internal surfaces when they are made accessible during periodic system surveillances or during the performance of maintenance activities. The applicant stated that the inspections will be conducted, at a minimum, in each 10-year period of the period of extended operation with a representative sample of 20 percent of the population. The staff further noted that the Fire Protection program manages the aging effects, such as loss of material, of fire barriers, such as fire dampers, through visual inspections and functional testing at least once every refueling cycle (24 months). Based on its review of components associated with item 3.3.1-90 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Fire Protection program as a supplement to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because the applicant's program is consistent, with enhancements, with GALL Report AMP XI.M26, which recommends periodic visual inspections of fire barriers, such as fire dampers, and because the inspections will be conducted at a greater frequency under the Fire Protection program (once every 2 years) compared to the inspection frequency (once every 10 years) under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.

The staff concludes that, for LRA Item 3.3.1-90, 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).

3.3.2.1.9 No Recommended Aging Effect

LRA Table 3.3.1, item 3.3.1-112 (GALL Report AMR item AP-282), addresses steel piping, piping components, and piping elements exposed to concrete, which have no AERMs and no recommended AMP as long as "(1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and (2) plant operating experience indicates no degradation of the concrete." The GALL Report recommends that there are no AERMs as long as the above conditions are met.

During its review of components associated with item 3.3.1-112 for which the applicant cited generic notes A and C, the staff identified the need for an RAI. In LR-ISG-2011-03, "Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, 'Buried and Underground Piping and Tanks,'" GALL Report AMP XI.M41 states that "buried piping and tanks are in direct contact with soil or concrete." Buried components are within the scope of GALL Report AMP XI.M41. GALL Report AMR items EP-111 and SP-145 state that loss of material is managed for piping and piping components exposed to soil or concrete by GALL Report AMP XI.M41. The staff acknowledges that there is an internal conflict in the GALL Report between GALL Report AMR item AP-282 and AMP XI.M41 and items EP-111 and SP-145. The staff has concluded that when components are exposed to concrete, if the encased components are not potentially externally exposed to water, there are no AERMs and no recommended AMP. However, the staff lacks sufficient information to conclude that the piping and piping components cited in LRA Tables 3.3.2-11 and 3.3.2-14 are not potentially exposed to water. By letter dated May 29, 2015, the staff issued RAI 3.3.2.1.11-1, requesting that the applicant state whether the carbon steel piping and piping components exposed to concrete cited in LRA Tables 3.3.2-11 and 3.3.2-14 are potentially exposed to water (e.g., groundwater).

In its response dated June 25, 2015, the applicant stated that the Essential Cooling Water, Nonessential Cooling Water, Reactor Core Isolation Cooling, Diesel Generator and Auxiliaries, Fire Protection, and Condensate Systems all include piping embedded in concrete that is located below the nominal groundwater table. The applicant revised LRA Tables 3.2.2-3, 3.3.2-8, 3.3.2-11, 3.3.2-12, 3.3.2-14, and 3.4.2-1 to state that loss of material will be managed for steel piping exposed to concrete by the Buried and Underground Piping program. The new AMR items cite generic note A.

The staff finds the applicant's response acceptable because the Buried and Underground Piping program includes periodic inspections and tests that are capable of detecting loss of material. The staff's concern described in RAI 3.3.2.1.11-1 is resolved.

The staff concludes that, for LRA item 3.3.1-112, 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).

LRA Table 3.3.1, item 3.3.1-119, addresses polyvinyl chloride (PVC) piping, piping components, and piping elements exposed to air-indoor uncontrolled for which there are no AERMs. The GALL Report recommends that there are no AERMs and no recommended AMP.

During its review of polymeric hoses associated with item 3.3.1-119 for which the applicant cited generic note A, the staff noted that the LRA states that there are no AERMs and no AMP. The applicant cited plant-specific note 1, which states that "[s]ome system drains include polymer hoses (Tygon® tubing). Tygon® tubing has no aging effects in a Waste Water environment. Tygon® is a registered trademark of Norton Performance Plastics that represents a family of various thermoplastic polymers. Tygon® is a PVC-based material that is clear or transparent and normally used for flexible tubing. It is considered non-aging and non-oxidizing, and has broad chemical resistance." Based on a review of the information at http://www.tubes-international.com/tygon_tubing.html (accessed on April 1, 2015), the staff confirmed that Tygon® tubing can be constructed of PVC materials. Based on its review of polymeric hoses associated with item 3.3.1-119 for which the applicant cited generic note A, the staff finds the applicant's proposal acceptable because GALL Report item SP-152 states that PVC piping, piping components, and piping elements have no AERMs and no proposed AMP.

The staff concludes that, for LRA item 3.3.1-119, 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).

LRA Table 3.3.1, item 3.3.1-120 addresses, in part, stainless steel piping, piping components, and piping elements exposed to concrete. AMR item 120 in SRP-LR Table 3.3-1 recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment.

During its review of structural stainless steel components that were identified in LRA Tables 3.5.2-1, 3.5.2-4, 3.5.2-5, 3.5.2-7, 3.5.2-8, 3.5.2-9, and 3.5.2-13 associated with LRA item 3.3.1-120 (for which the applicant cited generic note C), the staff noted that the applicant did not identify any AERMs for the exposure of the stainless steel components to a concrete environment. Specifically, the applicant identified that the following stainless steel components exposed to concrete do not have any AERMS and do not require aging management under 10 CFR 54.21(a)(3): (a) liners, liner anchors, and integral attachments, (b) anchor bolting, (c) hatches and plugs, (d) stainless steel concrete anchors, (e) electrical and mechanical penetration sleeves and assemblies, and (f) downcomers.

The staff performed a review of the applicant's basis to determine whether the applicant had omitted any AERMs for the exposure of these stainless steel components to a concrete environment. The staff noted that, although GALL Report AMR item VII.J. AP-19 identifies that there are not any AERMs for stainless steel piping and piping components exposed to concrete, other AMR items in the GALL Report identify that stainless steel components exposed to concrete may be susceptible to loss of material effects as a result of pitting or crevice corrosion aging mechanisms, including (a) AP-137 and SP-94 for stainless steel piping and piping components exposed to concrete, (b) SP-137 for stainless steel tanks exposed to concrete, and (c) AP-243 and SP-143 for stainless steel bolting exposed to concrete. Therefore, the staff determined that it did not have sufficient information to conclude that loss of material due to pitting and crevice corrosion would not need to be identified as an AERM for the exposure of these types of stainless steel components to a concrete environment. An analogous RAI on the topic of AERMs for steel components exposed to concrete is given in RAI 3.3.2.1.1-11, which was issued to Exelon in a letter dated May 29, 2015.

By letter dated August 28, 2015, the staff issued RAI 3.5.2.1-1, requesting that the applicant address these issues. The staff asked the applicant to provide its basis for why loss of material due to pitting and crevice corrosion has not been identified as an AERM for those structural liners, liner anchors, anchor bolting, electrical and mechanical penetration sleeves, and assemblies or hatches or plugs that are made from stainless steel materials and are exposed to a concrete environment. If loss of material due to pitting and crevice corrosion is an applicable AERM for the exposure of these components to concrete, the staff asked the applicant to identify and justify the AMP or programs that will be used to manage this aging effect during the period of extended operation.

The applicant responded to RAI 3.5.2.1-1 in a letter dated September 28, 2015. The applicant explained that there are 23 AMR items in LRA Tables 3.5.2-1, 3.5.2-4, 3.5.2-5, 3.5.2-7, 3.5.2-8, 3.5.2-9, and 3.5.2-13 for stainless steel components that are exposed to a "concrete" environment. The applicant stated that 14 of these AMR items apply to electrical penetration assemblies, mechanical penetrations, penetration sleeves, downcomers, and the suppression chamber liner that are located in the Primary Containment building or reactor building. The applicant stated that five of these AMR items apply to liners, liner anchors, and integral attachments located in the sumps of the Auxiliary Building, Diesel Generator Building, Radwaste Building, Reactor Building, and Turbine Building. The applicant stated that three of these AMR items are for hatches/plugs, the fuel pool line and casks loading pit liner, and reactor weld dryer and separator pool in the reactor building. The applicant stated that the last of these AMR items applies to the stainless steel anchor bolting in the Lake Screen House.

The applicant stated that these stainless steel components are located in areas of concrete building structures that separate them from direct contact with soil and or exposure to potential in-seepage of groundwater. The applicant also stated that no portions of these components are located in areas that are exposed to soil, are buried or underground, or are part of the underside of an aboveground metallic tank. Therefore, the applicant stated that the AMR items for these components are consistent with GALL AMR Item VII.J.AP-19, which recommends "none" as the aging effect for stainless steel components that are exposed to concrete inside of concrete buildings where the components are not buried or underground, exposed to soil, or part of inaccessible aboveground tank bottoms. The applicant stated that, because loss of material due to pitting and crevice corrosion is not an applicable AERM for these AMR items, there is no AMP needed to manage these components during the period of extended operation.

The staff noted that the applicant's explanation clarifies which stainless steel components are exposed to concrete and have AMR items aligned to AMR item 120 in SRP-LR Table 3.3-1 and to GALL AMR item VII.J.AP-19. The staff also noted that the applicant's response explains that the components in question are exposed to concrete in locations that are far from soil and would not be exposed to water seepage into the concrete materials. Therefore, the staff finds that the applicant has provided an acceptable basis for concluding that loss of material due to pitting or crevice corrosion is not an applicable AERM for these components because the components are located in concrete locations remote from any soil moisture or sources of water that could seep into the concrete materials. Based on this review, the staff finds that the applicant has provided an adequate basis for concluding that there are no AERMs for these stainless steel components because (a) the applicant has demonstrated that these AMR items for stainless steel components in concrete are consistent with GALL AMR item VII.J.AP-19 and (b) GALL Report AMR item VII.J.AP-19 does not identify any AERMs for stainless steel components that are exposed to concrete where there is no expectation of exposure to moisture or water seepage in the concrete. RAI 3.5.2.1-1, Parts 1 and 2, are resolved.

The staff concludes that for LRA item 3.3.1-120, 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).

3.3.2.2 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 system components and provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- cracking due to SCC and cyclic loading
- cracking due to SCC
- loss of material due to cladding breach
- loss of material due to pitting and crevice corrosion
- QA for aging management of nonsafety-related components
- ongoing review of operating experience

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 3.3.2.2. The staff's review of the applicant's further evaluation follows.

3.3.2.2.1 Cumulative Fatigue Damage

LRA Section 3.3.2.2.1, associated with LRA Table 3.3.1, items 3.3.1-1 and 3.3.1-2, addresses cumulative fatigue damage management for the Feedwater; High Pressure Core Spray; Reactor Coolant Pressure Boundary; Reactor Core Isolation Cooling; Reactor Water Cleanup; and Cranes, Hoists, and Refueling Equipment systems. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions," and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the crane load cycles as a TLAA for the Cranes, Hoists, and Refueling Equipment system is addressed in LRA Section 4.7. The applicant stated that its evaluation of the TLAA for the remaining systems is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1, which state that cumulative fatigue damage of auxiliary systems is a TLAA and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage.

LRA Section 3.3.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c) and that the evaluation of these TLAAs are addressed in LRA Sections 4.3 and 4.7. This is consistent with SRP-LR Section 3.3.2.2.1 and, therefore, is acceptable. The staff's evaluation of the TLAA for the Feedwater, High Pressure Core Spray, Reactor Coolant Pressure Boundary, Reactor Core Isolation Cooling, and Reactor Water Cleanup systems being managed for cumulative fatigue damage is documented in SER Section 4.3. The staff's evaluation of the TLAA for the Cranes, Hoists, and Refueling Equipment system being managed for cumulative fatigue damage is documented in SER Section 4.7.

3.3.2.2.2 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Section 3.3.2.2.2, associated with LRA Table 3.3.1, item 3.3.1-3, addresses cracking in the stainless steel non-regenerative heat exchanger exposed to treated water above 140 ºF. SRP-LR Section 3.3.2.2.2 and Table 3.3.1 identify item 3.3.1-3 as being applicable to PWRs only. The applicant stated that this item is not applicable because it only applies to PWRs. The staff evaluated the applicant's claim and finds it acceptable because the applicant's facility is not a PWR.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

LRA Section 3.3.2.2.3, associated with LRA Table 3.3.1, item 3.3.1-4, addresses cracking due to SCC in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.2.2.2.3 state that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and environments in which condensation or deliquescence is possible. The SRP-LR further states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage cracking due to SCC in stainless steel piping, piping components, and piping elements exposed to outdoor air in the Diesel Generator and Auxiliaries System.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant's External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.3.1-4, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant's program implements periodic inspections, which can detect cracking due to SCC.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.3.2.2.3 criteria.

For those items associated with LRA Section 3.3.2.2.3, the staff concludes 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).

3.3.2.2.4 Loss of Material Due to Cladding Breach

LRA Section 3.3.2.2.4, associated with LRA Table 3.3.1, item 3.3.1-5, addresses loss of material due to cladding breach in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The applicant stated that this item is not applicable because it only applies to PWRs. The staff confirmed that this item is associated only with PWR plants and that the applicant's reactor type is BWR; therefore, the staff finds the applicant's determination acceptable.

3.3.2.2.5 Loss of Material Due to Pitting and Crevice Corrosion

LRA Section 3.3.2.2.5, associated with LRA Table 3.3.1 item 3.3.1-6, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.3.2.2.5 state that loss of material could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and environments in which condensation or deliquescence is possible. The SRP-LR further states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to outdoor air in the Diesel Generator and Auxiliaries System.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant's External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.3.1-6, the staff finds that the applicant has met the further evaluation criteria and the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant's program implements periodic inspections, which can detect loss of material due to pitting and crevice corrosion.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.3.2.2.5 criteria. For those items associated with LRA Section 3.3.2.2.5, the staff concludes 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 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.

3.3.2.2.7 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

3.3.2.2.8 Loss of Material Due to Recurring Internal Corrosion

LRA Section 3.3.2.2.8, associated with LRA Table 3.3.1, item 3.3.1-127, addresses recurring internal corrosion in metallic piping, piping components, and tanks exposed to raw or waste water, which will be managed for loss of material by the Open-Cycle Cooling Water System, Fire Water System, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs. The criteria in SRP-LR Section 3.3.2.2.8 state that AMPs may need to be augmented beyond the recommendations in the GALL Report if recurring internal corrosion is identified during searches of plant-specific operating experience. The applicant addressed the further evaluation criteria of the SRP-LR by stating that LSCS will implement the following inspections:

- Inspections will be conducted at a minimum of 10 locations in both the essential cooling water system and non-essential cooling water system every 24 months until the frequency of occurrence for microbiologically-influenced corrosion no longer meets the criteria for recurring internal corrosion. These inspections will be conducted as part of the Open-Cycle Cooling Water program and will supplement the existing inspections that are being performed as part of the commitments to GL 89-13.
- Inspections will be conducted at five locations every year in the aboveground fire protection system piping that is susceptible to microbiologically-influenced corrosion. These inspection locations will be selected with process conditions similar to those in buried portions of the piping to provide sufficient understanding of the buried piping condition. In addition, these inspections will be conducted as part of the Fire Water System program and will continue until the frequency of occurrence for microbiologically-influenced corrosion no longer meets the criteria for recurring internal corrosion.
- Inspections will be conducted at 10 different locations in the plant drainage system during each 10-year period and will continue until the frequency of occurrences no longer meets the criteria for recurring internal corrosion. These inspections will be conducted as part of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program.
- For the above inspections, the selected inspection locations will be periodically reviewed to validate their relevance and will be adjusted as appropriate. The evaluation of inspection results will include a comparison to the nominal wall thickness or previous wall thickness measurement to determine the rate of corrosion degradation, a comparison of the design minimum allowable wall thickness to determine the acceptability of the component for continued use, and a determination of the re-inspection interval. If these examinations identify significant degradation, additional

locations will be examined in accordance with the component's classification (i.e., ASME Code Section III or non-ASME Code Section III piping) and the degree of degradation. Deficiencies will be documented in accordance with the 10 CFR Part 50, Appendix B, corrective action program.

The staff's evaluations of the applicant's Open-Cycle Cooling Water System, Fire Water System, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components programs are documented in SER Sections 3.0.3.2.5, 3.0.3.2.10, and 3.0.3.1.13, respectively.

In its review of the components associated with item 3.3.1-127, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the programs is acceptable because the applicant has augmented the three programs beyond the recommendations in the GALL Report for the corresponding AMPs with additional inspections and sample expansion criteria.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.3.2.2.8 criteria. For those items associated with LRA Section 3.3.2.2.8, the staff concludes 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).

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

For LRA Tables 3.3.2-1 through 3.3.2-25, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations that are not consistent with or are not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-25, the applicant indicated, by notes F through J, that the combination of component type, material, environment, and AERM does 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.

3.3.2.3.1 Closed-Cycle Cooling Water 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 Closed-Cycle Cooling Water System component groups. The staff's review did not identify any

AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Closed-Cycle Cooling Water System component groups are consistent with the GALL Report.

3.3.2.3.2 Combustible Gas Control 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 Combustible Gas Control System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Combustible Gas Control System component groups are consistent with the GALL Report.

3.3.2.3.3 Compressed Air 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 Compressed Air System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Compressed Air System component groups are consistent with the GALL Report.

3.3.2.3.4 Control Rod Drive 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 Control Rod Drive System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Control Rod Drive System component groups are consistent with the GALL Report.

3.3.2.3.5 Control Room Ventilation 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 Control Room Ventilation System component groups.

Elastomer Flexible Connections, Ducting, and Components Exposed to Internal Condensation. In LRA Tables 3.3.2-5, 3.3.2-8, and 3.3.2-22, the applicant stated that elastomer flexible connections, ducting, and components exposed to internal condensation will be managed for hardening, loss of strength, and loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which states that elastomers exposed to condensation are susceptible to hardening, loss of strength, and loss of materials, the staff finds that the applicant has identified all credible aging effects for the component, material, and environment combinations.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.13. 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 opportunistic visual inspections conducted by the program, with a representative sample of components periodically inspected, are capable of detecting hardening, loss of strength, and loss of material in elastomers by observing for cracking, other surface discontinuities, and discoloration.

Aluminum Heat Exchanger Fins and Copper Alloy Heat Exchanger Tubes Exposed to External Condensation. In LRA Tables 3.3.2-5 and 3.3.2-22, the applicant stated that aluminum heat exchanger fins and copper alloy (less than 15-percent zinc) heat exchanger tubes exposed to external condensation will be managed for reduction of heat transfer by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G and plant-specific notes, which state that the components are located within HVAC ducting, and the external surfaces are subject to the internal HVAC environment of condensation during normal operation. The notes also state that the visual inspections performed by the AMP are capable of identifying aging mechanisms that cause reduction of heat transfer for these components.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed loss of material for this component, material, and environment combination in other AMR items in LRA Tables 3.3.2-5 and 3.3.2-22. Based on its review of the GALL Report, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.13. The staff finds the applicant's proposal to manage aging using the above program acceptable because the opportunistic visual inspections conducted by the program, with a representative sample of components periodically inspected, are capable of detecting reduction in heat transfer in aluminum fins and copper alloy tubes.

3.3.2.3.6 Cranes, Hoists, and Refueling Equipment 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 Cranes, Hoists, and Refueling Equipment System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Cranes, Hoists and Refueling Equipment System component groups are consistent with the GALL Report.

3.3.2.3.7 Demineralized Water Makeup 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 Demineralized Water Makeup System component groups.

Carbon Steel and Copper Alloy with Internal Coatings, and Galvanized Steel Piping, Piping Components, and Heat Exchangers Exposed to Treated Water, Raw Water, and Waste Water.

In LRA Tables 3.3.2-7, 3.3.2-11, 3.3.2-12, 3.3.2-14, and 3.3.2-16, the applicant stated that carbon steel and copper alloy with 15-percent zinc or more, with internal coatings, and galvanized steel piping, piping components, and heat exchangers exposed to treated water, raw water, and waste water will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." LR-ISG-2013-01 Table 3.3-1, item 3.3.1-138, states that loss of coating integrity for metallic piping, piping components, and heat exchangers with internal coatings/linings exposed to treated water, raw water, and waste water is managed by GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The staff noted that, because LR-ISG-2013-01 was in a draft versus final status at the time the LRA was developed, the applicant chose to develop a plant-specific program to manage loss of coating integrity.

The staff's evaluation of the applicant's Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program is documented in SER Section 3.0.3.3.1. The staff finds the applicant's proposal to manage loss of coating integrity using the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program acceptable because the program includes periodic visual inspections capable of detecting loss of coating integrity by qualified individuals.

Copper Alloy Valve Body Exposed to Treated Water. In LRA Table 3.2.2-7, the applicant stated that copper alloy with 15-percent zinc or more valve bodies exposed to treated water will be managed for cracking by the Water Chemistry program. The AMR item cites generic note H, and plant-specific note 1, which states that vent valves in the supply pipe to the clean gland water tank are brass, ASTM B584, alloy material that has a zinc content of 15 percent. The One-Time Inspection (LRA Section B.2.1.21) program and Water Chemistry (LRA Section B.2.1.2) program are used to manage cracking in treated water for this component, material, and environment combination.

The staff noted that this material and environment combination is identified in the GALL Report, which states that copper alloy with 15-percent zinc or more exposed to treated water is susceptible to selective leaching and recommends GALL Report AMP XI.M33, "Selective Leaching," to manage the aging effect. However, the applicant has identified cracking as an additional aging effect. The applicant addressed the GALL Report-identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.2.2-7.

The staff's evaluation of the applicant's Water Chemistry and One-Time Inspection programs is documented in SER Sections 3.0.3.2.1 and 3.0.3.1.9, respectively. The staff finds the applicant's proposal to manage the effects of aging using the Water Chemistry program acceptable because the program consists of periodic monitoring of the treated water to control known detrimental contaminants, such as chlorides, dissolved oxygen, and sulfate concentrations, so that they remain below the levels known to result in loss of material or cracking. The staff noted that the One-Time inspection program will be used to verify the system-wide effectiveness of the Water Chemistry program by inspections focusing on locations that are isolated from the flow stream, that are stagnant, or that have low flow for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. Additionally, the One-Time Inspection program verifies either that unacceptable degradation is not occurring or triggers additional actions that will ensure that the intended function of affected components will be maintained during the period of extended operation.

3.3.2.3.8 Diesel Generator and Auxiliaries 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 Diesel Generator and Auxiliaries System component groups.

Carbon Steel Piping, Piping Components, and Piping Elements Exposed to Diesel Exhaust (Internal). In LRA Table 3.3.2-8, the applicant stated that carbon steel piping, piping components, and piping elements exposed to diesel exhaust will be managed for cumulative fatigue damage by a TLAA. The AMR item cites generic note H. The AMR item cites plant-specific note 1, which states that the TLAA used to manage fatigue in this component is evaluated in LRA Section 4.3.

The staff noted that this material and environment combination is identified in the GALL Report, which states that steel piping, piping components, and piping elements exposed to diesel exhaust are susceptible to loss of material and recommends GALL Report AMP XI.M38 to manage the aging effect. However, the applicant has identified cumulative fatigue damage as an additional aging effect. The applicant addressed the GALL Report-identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-8.

The staff's evaluation of the applicant's TLAA for metal fatigue is documented in SER Section 4.3.2, which evaluates the applicant's TLAA for ASME Code Section III, Class 2 and 3, and ANSI B31.1 allowable stress calculations. The staff finds the applicant's proposal to manage cumulative fatigue damage using a TLAA acceptable because the applicant provided the thermal and pressure transients that will affect this component and justified that the projected cycle occurrences of these transients will not be exceeded during the period of extended operation; therefore, the original stress calculations remain valid, and fatigue will be adequately managed.

Copper Alloy Heat Exchanger Tubes and Tube Sheets Exposed to Closed-Cycle Cooling Water. In LRA Table 3.3.2-8, the applicant stated that copper-alloy (with 15 percent or more zinc) heat exchanger tubes and tube sheets exposed to closed-cycle cooling water will be managed for cracking by the Closed Treated Water Systems program. The AMR items cite generic note H.

The staff noted that this material and environment combination is identified in the GALL Report, which states that copper-alloy heat exchanger components exposed to closed treated water are susceptible to loss of material and reduction of heat transfer due to fouling and recommends the Closed Treated Water Systems program to manage these aging effects. However, the applicant has identified cracking as an additional aging effect. The applicant addressed the aging effects identified in the GALL Report for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-8.

The staff's evaluation of the applicant's Closed Treated Water Systems program is documented in SER Section 3.0.3.2.6. The staff finds the applicant's proposal to manage cracking of copper-alloy heat exchanger components using the specified program acceptable because the Closed Treated Water Systems program manages cracking of heat exchanger component fabricated from other materials and because the applicant periodically verifies the effectiveness of the program through nondestructive examinations of representative samples of components.

Elastomer Ducting and Components Exposed to Internal Condensation. The staff's evaluation for elastomer ducting and components exposed to internal condensation, which will be managed for hardening and loss of strength by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.3.2.3.5.

3.3.2.3.9 Drywell Pneumatic 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 Drywell Pneumatic System component groups.

Polymer Piping and Piping Components Exposed to Air (External Indoor Uncontrolled) or Condensation. In LRA Table 3.3.2-9, the applicant stated that polymer piping and piping components exposed to air (external indoor uncontrolled) and condensation will be managed for change in material properties and loss of material by the External Surfaces Monitoring of Mechanical Components program and by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. Based on its review of the GALL Report, which states that polymers exposed to air (external indoor uncontrolled) and condensation are susceptible to change in material properties and loss of material, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.13. The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposal to manage aging using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and by using the External Surfaces Monitoring of Mechanical Components program acceptable because the opportunistic visual inspections conducted by the programs, with a representative sample of components periodically inspected, are capable of detecting change in material properties and loss of material in polymers by observing for cracking, other surface discontinuities, and discoloration.

3.3.2.3.10 Electrical Penetration Pressurization 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 Electrical Penetration Pressurization System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Electrical Penetration Pressurization System component groups are consistent with the GALL Report.

3.3.2.3.11 Essential Cooling Water 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 Essential Cooling Water System component groups.

Carbon Steel and Copper Alloy with 15% Zinc or More, with Internal Coatings, and Galvanized Steel Piping, Piping Components, and Heat Exchangers Exposed to Treated Water, Raw Water, and Waste Water. The staff's evaluation for carbon steel and copper alloy with 15-percent zinc or more, with internal coatings, and galvanized steel piping, piping components, and heat exchangers exposed to treated water, raw water, and waste water, which will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program and are associated with generic note H, is documented in SER Section 3.3.2.3.7.

3.3.2.3.12 Fire Protection 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 Fire Protection System component groups.

Carbon Steel and Copper Alloy with Internal Coatings, and Galvanized Steel Piping, Piping Components, and Heat Exchangers Exposed to Treated Water, Raw Water, and Waste Water. The staff's evaluation for carbon steel and copper alloy with 15-percent zinc or more, with internal coatings, and galvanized steel piping, piping components, and heat exchangers exposed to treated water, raw water, and waste water, which will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program and are associated with generic note H, is documented in SER Section 3.3.2.3.7.

Carbon Steel Piping, Piping Components, and Piping Elements Exposed to Diesel Exhaust (Internal). In LRA Table 3.3.2-12, the applicant stated that carbon steel piping, piping components, and piping elements exposed to diesel exhaust will be managed for cumulative fatigue damage by a TLAA. The AMR item cites generic note H. The AMR item cites plant-specific note 6, which states that the TLAA used to manage fatigue in this component is evaluated in LRA Section 4.3.

The staff noted that this material and environment combination is identified in the GALL Report, which states that steel piping, piping components, and piping elements exposed to diesel exhaust are susceptible to loss of material and recommends GALL Report AMP XI.M38 to manage the aging effect. However, the applicant has identified cumulative fatigue damage as an additional aging effect. The applicant addressed the GALL Report-identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-8.

The staff's evaluation of the applicant's TLAA for metal fatigue is documented in SER Section 4.3.2, which evaluates the applicant's TLAA for ASME Code Section III, Class 2 and 3, and ANSI B31.1 allowable stress calculations. The staff finds the applicant's proposal to manage cumulative fatigue damage using a TLAA acceptable because the applicant provided the thermal and pressure transients that will affect this component and justified that the projected cycle occurrences of these transients will not be exceeded during the period of extended operation; therefore, the original stress calculations remain valid, and fatigue will be adequately managed.

Ceramic Fiber, Calcium Silicate, and Mineral Fiber Fire Barriers Exposed to Uncontrolled Indoor Air (External). In LRA Table 3.3.2-12, the applicant stated that ceramic fiber, calcium silicate, and mineral fiber fire barriers exposed to uncontrolled indoor air (external) have no aging effects. The applicant further stated that these components will be managed by the Fire Protection program. The AMR items cite generic note F and plant-specific note 4, which states that "[b]ased on plant engineering experience, there are no aging effects requiring aging management for calcium silicate, ceramic fiber, and mineral fiber in an uncontrolled indoor air environment. These materials do not experience aging effects due to temperature, radiation, or chemicals capable of attacking the specific chemical composition. These materials in this non-aggressive air environment are not expected to experience significant aging effects. Nonetheless, the Fire Protection program is credited to assuring the absence of any aging effects."

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that ceramic fiber, calcium silicate, and mineral fiber are commonly used as fire barriers and/or insulation and are stable and non-reactive under ambient conditions. Maintaining material integrity and dimensional stability is key for these materials to fulfill their fire protection function. The staff further noted that, even though the GALL Report does not include AMR items for non-metallic fire barriers, GALL Report AMP XI.M26, "Fire Protection," indeed encompasses aging management for other fire resistance materials (e.g., flamastic, 3M™ fire wrapping, spray-on fire proofing material, and intumescent coating) within the "scope of program." GALL Report AMP XI.M26, "Fire Protection," recommends that these materials be managed for loss of material and cracking, increased hardness, shrinkage, and loss of strength. Although the applicant stated that there are no aging effects for these materials, it nevertheless assigned the Fire Protection program to age manage these fire barrier materials. The applicant's Fire Protection program specifies visual inspection of fire barrier materials at least once every refueling outage.

The staff's evaluation of the applicant's Fire Protection program is documented in SER Section 3.0.3.2.9. This program includes visual examinations of the fire barriers within the scope of license renewal to detect aging effects at least once every refueling outage. The staff finds that the applicant's proposal to manage the effects of aging using the Fire Protection program acceptable because signs of aging effects and material integrity, such as cracking and shrinkage, can be detected by visual inspections. Additionally, it is consistent with the NRC guidance in RG 1.189, "Fire Protection for Nuclear Power Plants," Section 1.7.4 "Inspection," Revision 2, dated October 2009, and nuclear industry practice (such as the guidance in NUREG-1552, "Fire Barrier Penetration Seals in Nuclear Power Plants," Supplement 1, dated January 1999) for ensuring the integrity of fire barriers through inspections.

Aluminum Silicate, Pyrocrete, and Gypsum Fire Barriers Exposed to Uncontrolled Indoor Air (External). In LRA Table 3.3.2-12, the applicant stated that aluminum silicate, pyrocrete, and gypsum fire barriers exposed to uncontrolled indoor air (external) will be managed for cracking by the Fire Protection program. The AMR items cite generic note F, and plant-specific note 3, which states that "the Fire Protection program will be used to manage the aging effects applicable to this component type, material, and environment combination."

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that aluminum silicate, pyrocrete, and gypsum are typically used as fire barriers and are stable and non-reactive under ambient conditions. Maintaining material integrity and dimensional stability is key for the materials to fulfill their fire protection function. The staff further noted that, even though the GALL Report does not include AMR items for non-metallic fire barriers, GALL Report AMP XI.M26, "Fire Protection," indeed encompasses aging management for other fire resistance materials (e.g., flamastic, 3M™ fire wrapping, spray-on fire proofing material, and intumescent coating) within the "scope of program." GALL Report AMP XI.M26, "Fire Protection," recommends that these materials be managed for loss of material and cracking, increased hardness, shrinkage, and loss of strength. It further specifies visual inspection of fire barrier materials at least once every refueling outage.

The staff's evaluation of the applicant's Fire Protection program is documented in SER Section 3.0.3.2.9. This program includes visual examinations of the fire barriers within the scope of license renewal to detect aging effects at least once every refueling outage. The staff finds the applicant's proposal to manage the effects of aging using the Fire Protection program acceptable because signs of aging effects and material integrity, such as cracking and shrinkage, can be detected by visual inspections. Additionally, it is consistent with the NRC guidance in RG 1.189, "Fire Protection for Nuclear Power Plants," Section 1.7.4, "Inspection," Revision 2, dated October 2009; nuclear industry practice (such as the guidance in NUREG-1552, "Fire Barrier Penetration Seals in Nuclear Power Plants," Supplement 1, dated January 1999); and the GALL Report recommendation for ensuring the integrity of fire barriers.

3.3.2.3.13 Fuel Pool Cooling and Storage 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 Fuel Pool Cooling and Storage System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Fuel Pool Cooling and Storage System component groups are consistent with the GALL Report.

3.3.2.3.14 Nonessential Cooling Water 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 Nonessential Cooling Water System component groups.

Carbon Steel and Copper Alloy with Internal Coatings, and Galvanized Steel Piping, Piping Components, and Heat Exchangers Exposed to Treated Water, Raw Water, and Waste Water. The staff's evaluation for carbon steel and copper alloy with 15-percent zinc or more, with internal coatings, and galvanized steel piping, piping components, and heat exchangers exposed to treated water, raw water, and waste water, which will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program and are associated with generic note H, is documented in SER Section 3.3.2.3.7.

3.3.2.3.15 Nonsafety-Related Ventilation 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 Nonsafety-Related Ventilation System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Nonsafety-Related Ventilation System component groups are consistent with the GALL Report.

3.3.2.3.16 Plant Drainage 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 Plant Drainage System component groups.

Carbon Steel and Copper Alloy with Internal Coatings, and Galvanized Steel Piping, Piping Components, and Heat Exchangers Exposed to Treated Water, Raw Water, and Waste Water. The staff's evaluation for carbon steel and copper alloy with 15-percent zinc or more, with internal coatings, and galvanized steel piping, piping components, and heat exchangers exposed to treated water, raw water, and waste water, which will be managed for loss of coating integrity by the Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program and are associated with generic note H, is documented in SER Section 3.3.2.3.7.

Polymer Hoses Exposed to Waste Water. In LRA Table 3.3.2-16, the applicant stated that polymer hoses exposed to waste water is not applicable to any AERM. The AMR items cite generic note G. The applicant stated that the polymer hoses used in waste water environment are Tygon® tubing, which is flexible transparent tubing, is considered non-aging and non-oxidizing, and has broad chemical resistance.

The staff noted that this material and environment combination is not identified in the GALL Report. The staff also noted that the applicant has been using this material in this environment and has not experienced any aging effects. The staff further noted that Tygon® flexible tubing is widely used in other applications with more aggressive environments with satisfactory results. Therefore, the staff finds the applicant's proposal acceptable because Tygon® polymer hoses exposed to a waste water environment are not expected to have any detrimental aging effects.

3.3.2.3.17 Primary Containment Ventilation 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 Primary Containment Ventilation System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Primary Containment Ventilation System component groups are consistent with the GALL Report.

3.3.2.3.18 Process Radiation Monitoring 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 Process Radiation Monitoring System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Process Radiation Monitoring System component groups are consistent with the GALL Report.

3.3.2.3.19 Process Sampling and Post-Accident Monitoring 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 Process Sampling and Post-Accident Monitoring System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Process Sampling and Post-Accident Monitoring System component groups are consistent with the GALL Report.

3.3.2.3.20 Radwaste 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 Radwaste System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Radwaste System component groups are consistent with the GALL Report.

3.3.2.3.21 Reactor Water Cleanup 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 Reactor Water Cleanup System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Reactor Water Cleanup System component groups are consistent with the GALL Report.

3.3.2.3.22 Safety-Related Ventilation 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 Safety-Related Ventilation System component groups.

<u>Elastomer Ducting and Components Exposed to Internal Condensation</u>. The staff's evaluation of elastomer ducting and components exposed to internal condensation, which will be managed for hardening, loss of strength, and loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.3.2.3.5.

<u>Aluminum Heat Exchanger Fins and Copper Alloy (Less Than 15-Percent Zinc) Heat Exchanger Tubes Exposed to Condensation</u>. The staff's evaluation of aluminum heat exchanger fins and copper alloy (less than 15-percent zinc) heat exchanger tubes exposed to external condensation, which will be managed for reduction of heat transfer by the Inspection of Internal

Surfaces in Miscellaneous Piping and Ducting Components program and are associated with generic note G, is documented in SER Section 3.3.2.3.5.

3.3.2.3.23 Standby Liquid Control 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 Standby Liquid Control System component groups.

<u>Copper Alloy Piping, Piping Components, and Piping Elements Exposed to Treated Water</u>. In LRA Table 3.2.2-23, the applicant stated that copper alloy with 15-percent zinc or more exposed to treated water will be managed for cracking by the Water Chemistry program. The AMR item cites generic note H, and plant-specific note 2, which states the aging effects for copper alloy with 15-percent zinc or more in a treated water environment include cracking. The One-Time Inspection (LRA Section B.2.1.21) program and Water Chemistry (LRA Section B.2.1.2) program are used to manage cracking for copper alloy with 15-percent zinc or more in a treated water environment.

The staff noted that this material and environment combination is identified in the GALL Report, which states that copper alloy with 15-percent zinc or more exposed to treated water is susceptible to selective leaching and recommends GALL Report AMP XI.M33, "Selective Leaching," to manage the aging effect. However, the applicant has identified cracking as an additional aging effect. The applicant addressed the GALL Report-identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.2.2-23.

The staff's evaluation of the applicant's Water Chemistry and One-Time Inspection programs is documented in SER Sections 3.0.3.2.1 and 3.0.3.1.9, respectively. The staff finds the applicant's proposal to manage the effects of aging using the Water Chemistry program acceptable because the program consists of periodic monitoring of the treated water to control known detrimental contaminants, such as chlorides, dissolved oxygen, and sulfate concentrations, so that they remain below the levels known to result in loss of material or cracking. The staff noted that the One-Time Inspection program will be used to verify the system-wide effectiveness of the Water Chemistry program by inspections focusing on locations that are isolated from the flow stream, that are stagnant, or that have low flow for extended periods and are susceptible to the gradual accumulation or concentration of agents that promote certain aging effects. Additionally, the One-Time Inspection program verifies either that unacceptable degradation is not occurring or triggers additional actions that will ensure the intended function(s) of affected components will be maintained during the period of extended operation.

<u>Glass Piping, Piping Components, and Piping Elements Exposed to Sodium Pentaborate Solution</u>. In LRA Table 3.3.2-23, the applicant stated that for glass piping, piping components, and piping elements exposed to a sodium pentaborate solution there is no aging effect and no proposed AMP. The AMR item cites generic note G.

The staff reviewed the associated item in the LRA to confirm that no credible aging effects are applicable to this component, material, and environment combination. The staff notes that LSCS UFSAR Table 9.3-2, "Standby Liquid Control System Operating Pressure Temperature Conditions," provides the temperature range of the associated sodium pentaborate solution as 70 to 100 °F. The staff finds the applicant's proposal acceptable based on its review of

EPRI 1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools,” which states that silicate glasses have a high resistance to corrosion in normal environments (i.e., an aqueous environment less than 250 °C (482 °F) and not containing hydrofluoric or phosphoric acids).

3.3.2.3.24 Suppression Pool Cleanup 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 Suppression Pool Cleanup System component groups. The staff’s review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Suppression Pool Cleanup System component groups are consistent with the GALL Report.

3.3.2.3.25 Traversing Incore Probe 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 Traversing Incore Probe System component groups. The staff’s review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Traversing Incore Probe System component groups are consistent with the GALL Report.

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 System

This section of the SER documents the staff’s review of the applicant’s AMR results for the steam and power conversion system components of the following:

- Condensate System
- Condenser and Air Removal System
- Feedwater System
- Main Steam System
- Main Turbine and Auxiliaries System

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides the AMR results for the steam and power conversion system components and component groups. LRA Table 3.4.1, “Summary of Aging Management Evaluations for the Steam and Power Conversion System,” 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 the applicant's AMRs to verify the applicant's claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.4-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or require no aging management are noted in Table 3.4-1 and are discussed in SER Section 3.4.2.1.1.

During its review, the staff also reviewed AMRs consistent with the GALL Report and those 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 of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with or are 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 of AMRs that are not consistent with or are not addressed in the GALL Report are documented in SER Section 3.4.2.3.

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 System Components in the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	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 due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.4.2.2.1)
Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor (3.4.1-2)	Cracking due to stress corrosion cracking	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.4.2.2.2)
Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor (3.4.1-3)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	Yes	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report (see SER Section 3.4.2.2.3)
Steel external surfaces, bolting exposed to air with borated water leakage (3.4.1-4)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to steam, treated water (3.4.1-5)	Wall thinning due to flow-accelerated corrosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion An exception applies to the Flow-Accelerated Corrosion program	Consistent with the GALL Report
Steel, stainless steel bolting exposed to soil (3.4.1-6)	Loss of preload	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-7)	Cracking due to cyclic loading, stress corrosion cracking	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external) (3.4.1-8)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Steel closure bolting exposed to air with steam or water leakage (3.4.1-9)	Loss of material due to general corrosion	Chapter XI.M18, "Bolting Integrity"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Copper alloy, nickel alloy, steel; stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), air – indoor, uncontrolled (external) (3.4.1-10)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Chapter XI.M18, "Bolting Integrity"	No	Bolting Integrity	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements, tanks, heat exchanger components exposed to steam, treated water >60°C (>140°F) (3.4.1-11)	Cracking due to stress corrosion cracking	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel; stainless steel tanks exposed to treated water (3.4.1-12)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to treated water (3.4.1-13)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements, PWR heat exchanger components exposed to steam, treated water (3.4.1-14)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel heat exchanger components exposed to treated water (3.4.1-15)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Copper alloy, stainless steel, nickel alloy, aluminum piping, piping components, and piping elements, heat exchanger components and tubes, PWR heat exchanger components exposed to treated water, steam (3.4.1-16)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Copper alloy heat exchanger tubes exposed to treated water (3.4.1-17)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Copper alloy, stainless steel heat exchanger tubes exposed to treated water (3.4.1-18)	Reduction of heat transfer due to fouling	Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection"	No	One-Time Inspection, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report
Stainless steel, steel heat exchanger components exposed to raw water (3.4.1-19)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Copper alloy, stainless steel piping, piping components, and piping elements exposed to raw water (3.4.1-20)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel heat exchanger components exposed to raw water (3.4.1-21)	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel, copper alloy, steel heat exchanger tubes, heat exchanger components exposed to raw water (3.4.1-22)	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
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 stress corrosion cracking	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
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	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel heat exchanger components exposed to closed-cycle cooling water (3.4.1-25)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water (3.4.1-26)	Loss of material due to pitting and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water (3.4.1-27)	Loss of material due to pitting, crevice, and galvanic corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, copper alloy heat exchanger components and tubes, heat exchanger tubes exposed to closed-cycle cooling water (3.4.1-28)	Reduction of heat transfer due to fouling	Chapter XI.M21A, "Closed Treated Water Systems"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel tanks exposed to air – outdoor (external) (3.4.1-29)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel, Stainless Steel, Aluminum Tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.4.1-30)	Loss of material due to general (steel only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only)	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Stainless steel, aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation (3.4.1-31)	Loss of material due to pitting, and crevice corrosion; cracking due to stress corrosion cracking	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Aboveground Metallic Tanks	Consistent with the GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil (3.4.1-32)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements exposed to treated water, raw water, closed-cycle cooling water (3.4.1-33)	Loss of material due to selective leaching	Chapter XI.M33, "Selective Leaching"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel external surfaces exposed to air – indoor, uncontrolled (external), air – outdoor (external), condensation (external) (3.4.1-34)	Loss of material due to general corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Aluminum piping, piping components, and piping elements exposed to air – outdoor (3.4.1-35)	Loss of material due to pitting and crevice corrosion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to air – outdoor (internal) (3.4.1-36)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to condensation (internal) (3.4.1-37)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-38)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically -influenced corrosion; fouling that leads to corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to condensation (internal) (3.4.1-39)	Loss of material due to pitting and crevice corrosion	Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to lubricating oil (3.4.1-40)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel heat exchanger components exposed to lubricating oil (3.4.1-41)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Aluminum piping, piping components, and piping elements exposed to lubricating oil (3.4.1-42)	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-43)	Loss of material due to pitting and crevice corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements, heat exchanger components exposed to lubricating oil (3.4.1-44)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Aluminum heat exchanger components and tubes exposed to lubricating oil (3.4.1-45)	Reduction of heat transfer due to fouling	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Stainless steel, steel, copper alloy heat exchanger tubes exposed to lubricating oil (3.4.1-46)	Reduction of heat transfer due to fouling	Chapter XI.M39, “Lubricating Oil Analysis,” and Chapter XI.M32, “One-Time Inspection”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)
Steel (with coating or wrapping) stainless steel, nickel alloy piping, piping components, and piping elements; tanks exposed to soil or concrete (3.4.1-47)	Loss of material due to general (steel only), pitting, crevice, and microbiologically -influenced corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Buried and Underground Piping	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, nickel alloy bolting exposed to soil (3.4.1-48)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete (3.4.1-49)	Loss of material due to pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel bolting exposed to soil (3.4.1-50)	Loss of material due to general, pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Underground stainless steel, nickel alloy, steel piping, piping components, and piping elements (3.4.1-50x)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Steel piping, piping components, and piping elements exposed to concrete (3.4.1-51)	None	None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete	No, if conditions are met.	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Aluminum piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (internal/external) (3.4.1-52)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Copper alloy (≤15% Zn and ≤8% Al) piping, piping components, and piping elements exposed to air with borated water leakage (3.4.1-53)	None	None	NA - No AEM or AMP	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (external) (3.4.1-54)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Glass piping elements exposed to lubricating oil, air – outdoor, condensation (internal/external), raw water, treated water, air with borated water leakage, gas, closed-cycle cooling water, air – indoor, uncontrolled (external) (3.4.1-55)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) (3.4.1-56)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Nickel alloy, PVC piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal) (3.4.1-57)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), concrete, gas, air – indoor, uncontrolled (internal) (3.4.1-58)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801 (the GALL Report)	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to air – indoor controlled (external), gas (3.4.1-59)	None	None	NA - No AEM or AMP	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Any material, piping, piping components, and piping elements exposed to treated water (3.4.1-60)	Wall thinning due to erosion	Chapter XI.M17, "Flow-Accelerated Corrosion"	No	Flow-Accelerated Corrosion An exception applies to the Flow-Accelerated Corrosion program	Consistent with the GALL Report
Metallic piping, piping components, and tanks exposed to raw water or waste water (3.4.1-61)	Loss of material due to recurring internal corrosion	A plant-specific aging management program is to be evaluated to address recurring internal corrosion	Yes, plant-specific	Not Applicable	Not Applicable to LSCS (see SER Section 3.4.2.2.6)
Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated Water (3.4.1-62)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M29, "Aboveground Metallic Tanks"	No	Aboveground Metallic Tanks	Consistent with the GALL Report
Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor (3.4.1-63)	Loss of material due to general (steel, and copper alloy), pitting, or crevice corrosion, and cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only)	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only)	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Jacketed calcium silicate or fiberglass insulation in an air-indoor uncontrolled or air-outdoor environment (3.4.1-64)	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report
Jacketed FOAMGLAS® (glass dust) insulation in an air-indoor uncontrolled or air-outdoor environment (3.4.1-65)	Reduced thermal insulation resistance due to moisture intrusion	Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components"	No	External Surfaces Monitoring of Mechanical Components	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.4.1-66)	Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used (see SER Section 3.4.2.1.1)
Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil (3.4.1-67)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used (see SER Section 3.4.2.1.1)
Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water (3.4.1-68)	Loss of material due to selective leaching	Chapter XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks”	No	Not Used	Not Used (see SER Section 3.4.2.1.1)

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 System components:

- Aboveground Metallic Tanks
- Bolting Integrity
- Buried and Underground Piping
- External Surfaces Monitoring of Mechanical Components
- Flow-Accelerated Corrosion
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- TLAA
- Water Chemistry

LRA Tables 3.4.2-1 through 3.4.2-5 summarize AMRs for the Steam and Power Conversion System components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report for those items that the staff determined were bounded by the GALL Report evaluation. However, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.4.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.4.1, items 3.4.1-4, 3.4.1-13, 3.4.1-17, 3.4.1-21, 3.4.1-36, 3.4.1-38, 3.4.1-41, 3.4.1-42, 3.4.1-45, and 3.4.1-46, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.4.1, items 3.4.1-6, 3.4.1-7, 3.4.1-9, 3.4.1-19, 3.4.1-20, 3.4.1-22 through 3.4.1-30, 3.4.1-32, 3.4.1-33, 3.4.1-39, 3.4.1-40, 3.4.1-43, 3.4.1-44, 3.4.1-48 through 3.4.1-52, 3.4.1-56, 3.4.1-57, and 3.4.1-59, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

SER Table 3.4-1, items 3.4.1-66, 3.4.1-67, and 3.4.1-68, reflect changes to the SRP-LR incorporated by LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers and Tanks." The ISG added these items to manage loss of coating integrity and to allow applicants to credit the new GALL Report AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion; fouling that leads to corrosion; or selective leaching in certain components. Because the final ISG was issued only shortly before the LRA was submitted, the applicant did not cite SRP-LR items 3.4.1-66, 3.4.1-67, and 3.4.1-68 in the LRA. The staff evaluated the corresponding items in the GALL Report and, based on a review of plant-specific documents during the AMP audit, determined that they are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs in the steam and power conversion systems at LSCS. Therefore, the staff finds the applicant's approach to not cite these items acceptable.

For LRA Table 3.4.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable. For these items, the staff reviewed sources beyond the LRA and UFSAR or issued one or more RAIs, or both, in order to verify the applicant's claim of non-applicability.

LRA Table 3.4.1, item 3.4.1-9, addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends GALL Report 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 there is no steel closure bolting exposed to air with steam or water leakage in the steam and power conversion system. The staff evaluated the applicant's claim and notes that the possibility for the steel closure bolts in the steam and power conversion system to be exposed to an air with steam or water leakage environment during the period of extended operation cannot be eliminated. However, the staff finds that the steel closure bolts in the steam and power conversion system will be adequately age managed for loss of material due to general corrosion and finds it acceptable because of the following:

- Through LRA Table 3.4.1, item 3.4.1-8, the applicant will use the Bolting Integrity program to manage loss of material of all closure bolting in the steam and power conversion system.

- The Bolting Integrity program conducts periodic visual inspections, which are capable of detecting loss of material due to general corrosion in closure bolting.
- Use of this program is consistent with GALL Report recommendations.

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
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- QA for aging management of nonsafety-related components
- ongoing review of operating experience
- loss of material due to recurring internal corrosion

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 3.4.2.2. The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 is associated with LRA Table 3.4.1, item 3.4.1-1, that addresses cumulative fatigue damage management for the Condenser and Air Removal, Feedwater, Main Steam, and Reactor Coolant Pressure Boundary systems. The applicant addressed the further evaluation criteria of the SRP-LR by stating that fatigue is a TLAA, as defined in 10 CFR 54.3, "Definitions," and is required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that its evaluation of the TLAA is addressed in LRA Section 4.3.

The staff reviewed LRA Section 3.4.2.2.1 against the criteria in SRP-LR Section 3.4.2.2.1, which state that cumulative fatigue damage of steam and power conversion system components is a TLAA and that these TLAAs are to be evaluated in accordance with the TLAA acceptance criteria requirements of 10 CFR 54.21(c). The staff reviewed the applicant's AMR items and determined that the AMR results are consistent with the recommendations of the GALL Report and SRP-LR for managing cumulative fatigue damage.

LRA Section 3.4.2.2.1 states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.4.2.2.1 and, therefore, is acceptable. The staff's evaluation of the TLAA for Condenser and Air Removal, Feedwater, Main Steam, and Reactor Coolant Pressure Boundary systems components being managed for cumulative fatigue damage is documented in SER Section 4.3.

3.4.2.2.2 Cracking Due to Stress Corrosion Cracking

LRA Section 3.4.2.2.2, associated with LRA Table 3.4.1, item 3.4.1-2, addresses cracking due to SCC in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.4.2.2.2 state that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and environments in which condensation or deliquescence is possible. The SRP-LR further states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage cracking due to SCC of stainless steel components exposed to outdoor air in the Condensate System.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant's External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.4.1-2, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant's program includes periodic inspections, which can detect cracking due to SCC.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.4.2.2.2 criteria.

For those items associated with LRA Section 3.4.2.2.2, the staff concludes 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 Pitting and Crevice Corrosion

LRA Section 3.4.2.2.3, associated with LRA Table 3.4.1, item 3.4.1-3, addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air. The criteria in SRP-LR Section 3.4.2.2.3 state that loss of material could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and environments in which condensation or deliquescence is possible. The SRP-LR also states that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," is an acceptable method to manage the aging effect. The applicant addressed the further evaluation criteria of the SRP-LR and stated that this item is applicable to its units and within the scope of license renewal. The applicant also stated that it will implement the External Surfaces Monitoring of Mechanical Components program to manage loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to outdoor air in the Condensate System.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff noted that the applicant's External Surfaces Monitoring of Mechanical Components program, when implemented, includes periodic representative inspections of components in which condensation could occur; therefore, the program will be capable of managing the aging effect. In its review of the components associated with item 3.4.1-3, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the External Surfaces Monitoring of Mechanical Components program is acceptable because the applicant's program includes periodic inspections, which can detect loss of material due to pitting and crevice corrosion.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.4.2.2.3 criteria.

For those items associated with LRA Section 3.4.2.2.3, the staff concludes 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).

3.4.2.2.4 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.

3.4.2.2.5 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

3.4.2.2.6 Loss of Material Due to Recurring Internal Corrosion

LRA Section 3.4.2.2.6, associated with LRA Table 3.4.1, item 3.4.1-61, addresses loss of material due to recurring internal corrosion in metallic piping, piping components, and tanks exposed to raw or waste water. The criteria in SRP-LR Section 3.4.2.2.6 state that AMPs may need to be augmented beyond the recommendations in the GALL Report if recurring internal corrosion is identified during searches of plant-specific operating experience conducted for the development of the LRA. The applicant stated that this item is not applicable because its review of operating experience for the steam and power conversion system did not identify instances of recurring internal corrosion with the threshold frequency specified in LR-ISG-2012-02. The staff evaluated the applicant's claim and finds it acceptable because, as noted in the Audit Report, the staff conducted an independent search of the past 10 years of operating experience reports and did not identify repetitive occurrences of internal corrosion in the steam and power conversion system with a frequency greater than that given in LR-ISG-2012-02.

3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-5, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations that are not consistent with or are not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does 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 that are 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 Condensate 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 Condensate System component groups.

Aluminum Alloy Tanks and Piping Exposed to Outdoor Air, Condensation, Concrete, and Soil. In LRA Table 3.4.2-1, the applicant stated that, for aluminum alloy tanks and piping exposed to outdoor air, condensation, concrete, and soil, cracking is not applicable and that no AMP is proposed. The AMR items cite generic note I. The AMR items also cite plant-specific note 3, which states that the associated aluminum alloys are not susceptible to cracking due to SCC. The plant-specific note states that the alloys of construction are not susceptible to SCC based on their elemental composition, and references EPRI Report 1010639, Revision 4, dated January 2006 as the technical basis.

The staff reviewed the associated items 3.4.1-31 and 3.4.1-63 in the LRA and confirmed that the aging effect of cracking due to SCC is not applicable for this component, material, and environment combination. The staff notes that AMR items 3.4.1-31 and 3.4.1-63 also manage loss of material using the Aboveground Metallic Tanks program and the External Surfaces Monitoring of Mechanical Components program, respectively. The staff's evaluation of the External Surfaces Monitoring of Mechanical Components program and the Aboveground Metallic Tanks program is documented in SER Sections 3.0.3.1.12 and 3.0.3.2.11, respectively. The latter includes the staff's basis for concluding that cracking due to SCC is not an AERM for the associated aluminum alloys.

3.4.2.3.2 Condenser and Air Removal 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 Condenser and Air Removal System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Condenser and Air Removal System component groups are consistent with the GALL Report.

3.4.2.3.3 Feedwater 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 Feedwater System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Feedwater System component groups are consistent with the GALL Report.

3.4.2.3.4 Main Steam 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 Main Steam System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Main Steam System component groups are consistent with the GALL Report.

3.4.2.3.5 Main Turbine and Auxiliaries 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 Main Turbine and Auxiliaries System component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Main Turbine and Auxiliaries System component groups 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 Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the Structures and Component Supports components and commodity groups of the following:

- Auxiliary Building
- Component Supports Commodity Group
- Cooling Lake
- Diesel Generator Building
- Lake Screen House
- Offgas Building
- Primary Containment
- Radwaste Building
- Reactor Building
- Structural Commodity Group
- Switchyard Structures
- Tank Foundations and Dikes
- Turbine Building
- Yard Structures

The GALL Report organizes safety-related and other structures (other than containments), such as those listed above, into nine groups. These nine groups, which are referenced in the LRA and staff's evaluation as Groups 1 through 9 Structures, are generically defined in GALL Report Chapter III.A.

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the structures and component supports components and component groups. LRA Table 3.5.1, "Summary of Aging Management Evaluations for the Structures and Component Supports," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the structures and component supports 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 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).

The staff conducted a review of the applicant's AMRs to verify the applicant's claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.5-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or require no aging management are noted in Table 3.5-1 and discussed in SER Section 3.5.2.1.1. Details of the staff's evaluation of AMRs that the applicant claimed are consistent with the GALL Report, but for which a different AMP from the program recommended in the GALL Report is used to manage aging, and AMRs for which the staff requested additional information, are documented in SER Sections 3.5.2.1.2 through 3.5.2.1.6.

During its review, the staff also reviewed AMRs consistent with the GALL Report and those 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 evaluations of AMRs for which the GALL Report recommends further evaluation 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 are 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 of AMRs that are not consistent with or are not addressed in the GALL Report are documented in SER Section 3.5.2.3.

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 (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete: dome; wall; basemat; ring girders; buttresses, concrete elements, all (3.5.1-1)	Cracking and distortion due to increased stress levels from settlement	Chapter XI.S2, "ASME Section XI, Subsection IWL" or Chapter XI.S6, "Structure Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Structures Monitoring, and ASME Section XI, Subsection IWL	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Concrete: foundation; subfoundation (3.5.1-2)	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if a de-watering system is relied upon to control settlement	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)
Concrete: dome; wall; basemat; ring girders; buttresses; Concrete: containment; wall; basemat; Concrete: basemat, concrete fill-in annulus (3.5.1-3)	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes, if temperature limits are exceeded	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)
Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell (3.5.1-4)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examinations	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements (inaccessible areas): liner; liner anchors; integral attachments; Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable) (3.5.1-5)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is indicated from the IWE examinations	ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Steel elements: torus shell (3.5.1-6)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE" and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes, if corrosion is significant. Recoating of the torus is recommended	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)
Steel elements: torus ring girders; downcomers; Steel elements: suppression chamber shell (interior surface) (3.5.1-7)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE"	Yes, if corrosion is significant	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)
Pre-stressing system: tendons (3.5.1-8)	Loss of prestress due to relaxation; shrinkage; creep; elevated temperature	Yes, TLAA	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Penetration sleeves; penetration bellows Steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell; unbraced downcomers, Steel elements: vent header; downcomers (3.5.1-9)	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Penetration sleeves; penetration bellows (3.5.1-10)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat (3.5.1-11)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further 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 LSCS (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete (inaccessible areas): basemat, concrete fill-in annulus (3.5.1-12)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	Structures Monitoring, and ASME Section XI, Subsection IWL	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat (3.5.1-13)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): containment; wall; basemat (3.5.1-14)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
Concrete (accessible areas): basemat (3.5.1-15)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete (accessible areas): basemat, Concrete: containment; wall; basemat (3.5.1-16)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, “ASME Section XI, Subsection IWL,” or Chapter XI.S6, “Structures Monitoring”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses (3.5.1-17)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat (3.5.1-18)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas): containment; wall; basemat, Concrete (accessible areas): basemat, concrete fill-in annulus (3.5.1-19)	Cracking due to expansion from reaction with aggregates	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	ASME Section XI, Subsection IWL	Consistent with the GALL Report
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): containment; wall; basemat (3.5.1-20)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	ASME Section XI, Subsection IWL	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel, Concrete (accessible areas): basemat; reinforcing steel, Concrete (accessible areas): dome; wall; basemat; reinforcing steel (3.5.1-21)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	ASME Section XI, Subsection IWL	Consistent with the GALL Report
Concrete (inaccessible areas): basemat; reinforcing steel (3.5.1-22)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel (3.5.1-23)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, “ASME Section XI, Subsection IWL,” or Chapter XI.S6, “Structures Monitoring”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat (3.5.1-24)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S2, “ASME Section XI, Subsection IWL,” or Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel (3.5.1-25)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S2, “ASME Section XI, Subsection IWL,” or Chapter XI.S6, “Structures Monitoring”	No	Not Applicable (PWRs only)	Not Applicable to BWRs (see SER Section 3.5.2.1.1)
Moisture barriers (caulking, flashing, and other sealants) (3.5.1-26)	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	Chapter XI.S1, “ASME Section XI, Subsection IWE”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, suppression pool shell (3.5.1-27)	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Personnel airlock, equipment hatch, CRD hatch (3.5.1-28)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	10 CFR Part 50, Appendix J, and ASME Section XI, Subsection IWE	Consistent with the GALL Report
Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms (3.5.1-29)	Loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	10 CFR Part 50, Appendix J, and ASME Section XI, Subsection IWE	Consistent with the GALL Report
Pressure-retaining bolting (3.5.1-30)	Loss of preload due to self-loosening	Chapter XI.S1, “ASME Section XI, Subsection IWE,” and Chapter XI.S4, “10 CFR Part 50, Appendix J”	No	10 CFR Part 50, Appendix J, and ASME Section XI, Subsection IWE	Consistent with the GALL Report
Pressure-retaining bolting, Steel elements: downcomer pipes (3.5.1-31)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, “ASME Section XI, Subsection IWE”	No	ASME Section XI, Subsection IWE	Consistent with the GALL Report
Prestressing system: tendons; anchorage components (3.5.1-32)	Loss of material due to corrosion	Chapter XI.S2, “ASME Section XI, Subsection IWL”	No	ASME Section XI, Subsection IWL	Consistent with the GALL Report
Seals and gaskets (3.5.1-33)	Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects	Chapter XI.S4, “10 CFR Part 50, Appendix J “	No	10 CFR Part 50, Appendix J	Consistent with the GALL Report
Service Level I coatings (3.5.1-34)	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, “Protective Coating Monitoring and Maintenance”	No	Protective Coating Monitoring and Maintenance Program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements (accessible areas): liner; liner anchors; integral attachments, Penetration sleeves, Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket regions;, Steel elements (accessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable), Steel elements (accessible areas): drywell shell; drywell head (3.5.1-35)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	10 CFR Part 50, Appendix J, and ASME Section XI, Subsection IWE	Consistent with the GALL Report
Steel elements: drywell head; downcomers (3.5.1-36)	Fretting or lockup due to mechanical wear	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	ASME Section XI, Subsection IWE	Consistent with the GALL Report
Steel elements: suppression chamber (torus) liner (interior surface) (3.5.1-37)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	10 CFR Part 50, Appendix J, ASME Section XI, Subsection IWE, and Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.1.2)
Steel elements: suppression chamber shell (interior surface) (3.5.1-38)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Steel elements: vent line bellows (3.5.1-39)	Cracking due to stress corrosion cracking	Chapter XI.S1, "ASME Section XI, Subsection IWE," and Chapter XI.S4, "10 CFR Part 50, Appendix J"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Unbraced downcomers, Steel elements: vent header; downcomers (3.5.1-40)	Cracking due to cyclic loading (CLB fatigue analysis does not exist)	Chapter XI.S1, "ASME Section XI, Subsection IWE"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt (3.5.1-41)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report
Groups 1-3, 5, 7-9: concrete (inaccessible areas): foundation (3.5.1-42)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
All Groups except Group 6: concrete (inaccessible areas): all (3.5.1-43)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
All Groups: concrete: all (3.5.1-44)	Cracking and distortion due to increased stress levels from settlement	Chapter XI.S6, “Structures Monitoring” If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 1-3, 5-9: concrete: foundation; subfoundation (3.5.1-45)	Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation	Chapter XI.S6, “Structures Monitoring” If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 1-3, 5-9: concrete: foundation; subfoundation (3.5.1-46)	Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation	Chapter XI.S6, "Structures Monitoring" If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.2)
Groups 1-5, 7-9: concrete (inaccessible areas): exterior above- and below-grade; foundation (3.5.1-47)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes,	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 1-5: concrete: all (3.5.1-48)	Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local)	A plant-specific aging management program is to be evaluated.	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.2)
Groups 6 - concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab (3.5.1-49)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 6: concrete (inaccessible areas): all (3.5.1-50)	Cracking due to expansion from reaction with aggregates	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, and Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)
Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab (3.5.1-51)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Further evaluation is required to determine if a plant-specific aging management program is needed.	Yes	Structures Monitoring	Consistent with the GALL Report (see SER Section 3.5.2.2.2)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 7, 8 - steel components: tank liner (3.5.1-52)	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.2)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-53)	Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists)	Yes, TLAA	Yes,	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.2.2)
All groups except 6: concrete (accessible areas): all (3.5.1-54)	Cracking due to expansion from reaction with aggregates	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Building concrete at locations of expansion and grouted anchors; grout pads for support base plates (3.5.1-55)	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Concrete: exterior above- and below-grade; foundation; interior slab (3.5.1-56)	Loss of material due to abrasion; cavitation	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report
Constant and variable load spring hangers; guides; stops (3.5.1-57)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	ASME Section XI, Subsection IWF	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds (3.5.1-58)	Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report
Group 6: concrete (accessible areas): all (3.5.1-59)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report
Group 6: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-60)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report
Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab (3.5.1-61)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group 6: wooden piles; sheeting (3.5.1-62)	Loss of material; change in material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay	Chapter XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants” or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-63)	Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above- and below-grade; foundation (3.5.1-64)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible areas): all (3.5.1-65)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior (3.5.1-66)	Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 1-5, 7, 9: concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 - concrete (inaccessible areas): below-grade exterior; foundation, Group 6: concrete (inaccessible areas): all (3.5.1-67)	Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
High-strength structural bolting (3.5.1-68)	Cracking due to stress corrosion cracking	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
High-strength structural bolting (3.5.1-69)	Cracking due to stress corrosion cracking	Chapter XI.S6, “Structures Monitoring” Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts.	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Masonry walls: all (3.5.1-70)	Cracking due to restraint shrinkage, creep, and aggressive environment	Chapter XI.S5, “Masonry Walls”	No	Masonry Walls, and Structures Monitoring	Consistent with the GALL Report
Masonry walls: all (3.5.1-71)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S5, “Masonry Walls”	No	Masonry Walls, and Structures Monitoring	Consistent with the GALL Report
Seals; gasket; moisture barriers (caulking, flashing, and other sealants) (3.5.1-72)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring, Aboveground Metallic Tanks, and ASME Section XI, Subsection IWL	Consistent with the GALL Report (see SER Section 3.5.2.1.3)
Service Level I coatings (3.5.1-73)	Loss of coating integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage	Chapter XI.S8, “Protective Coating Monitoring and Maintenance”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Sliding support bearings; sliding support surfaces (3.5.1-74)	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Sliding surfaces (3.5.1-75)	Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	ASME Section XI, Subsection IWF	Consistent with the GALL Report
Sliding surfaces: radial beam seats in BWR drywell (3.5.1-76)	Loss of mechanical function due to corrosion, distortion, dirt, overload, wear	Chapter XI.S6, “Structures Monitoring”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Steel components: all structural steel (3.5.1-77)	Loss of material due to corrosion	Chapter XI.S6, “Structures Monitoring” 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.	No	Structures Monitoring	Consistent with the GALL Report
Steel components: fuel pool liner (3.5.1-78)	Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion	Chapter XI.M2, “Water Chemistry,” and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels	Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.5.2.1.4)
Steel components: piles (3.5.1-79)	Loss of material due to corrosion	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Structural bolting (3.5.1-80)	Loss of material due to general, pitting and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Structures Monitoring, Inspection of Overhead Heavy and Light Load (Related to Refueling) Handling Systems, and ASME Section XI, Subsection IWL	Consistent with the GALL Report (see SER Section 3.5.2.1.2)
Structural bolting (3.5.1-81)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	ASME Section XI, Subsection IWF	Consistent with the GALL Report
Structural bolting (3.5.1-82)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S6, "Structures Monitoring"	No	Structures Monitoring	Consistent with the GALL Report
Structural bolting (3.5.1-83)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs.	No	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Consistent with the GALL Report
Structural bolting (3.5.1-84)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Structural bolting (3.5.1-85)	Loss of material due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	ASME Section XI, Subsection IWF, Water Chemistry, Inspection of Overhead Heavy and Light Load (Related to Refueling) Handling Systems An exception applies to the Water Chemistry program	Consistent with the GALL Report (see SER Section 3.5.2.1.5)
Structural bolting (3.5.1-86)	Loss of material due to pitting and crevice corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Structural bolting (3.5.1-87)	Loss of preload due to self-loosening	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	ASME Section XI, Subsection IWF	Consistent with the GALL Report
Structural bolting (3.5.1-88)	Loss of preload due to self-loosening	Chapter XI.S6, "Structures Monitoring"	No	Structures Monitoring, Inspection of Overhead Heavy and Light Load (Related to Refueling) Handling Systems, and ASME Section XI, Subsection IWL	Consistent with the GALL Report (see SER Section 3.5.2.1.6)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-89)	Loss of material due to boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No	Not Applicable (PWR only)	Not Applicable to BWRs (see SER Section 3.5.2.1.1)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-90)	Loss of material due to general (steel only), pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry," for BWR water, and Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	ASME Section XI, Subsection IWF, and Water Chemistry An exception applies to the Water Chemistry program	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-91)	Loss of material due to general and pitting corrosion	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	ASME Section XI, Subsection IWF	Consistent with the GALL Report
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-92)	Loss of material due to general and pitting corrosion	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring	Consistent with the GALL Report
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-93)	Loss of material due to pitting and crevice corrosion	Chapter XI.S6, “Structures Monitoring”	No	Structures Monitoring, and Open-Cycle Cooling Water System	Consistent with the GALL Report (see SER Section 3.5.2.1.5)
Vibration isolation elements (3.5.1-94)	Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.5.2.1.1)
Aluminum, galvanized steel and stainless steel Support members; welds; bolted connections; support anchorage to building structure exposed to air – indoor, uncontrolled (3.5.1-95)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report

3.5.2.1 AMR 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 Supports components:

- 10 CFR Part 50, Appendix J
- Aboveground Metallic Tanks
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWF
- ASME Section XI, Subsection IWL
- External Surfaces Monitoring of Mechanical Components
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- Masonry Walls

- One-Time Inspection
- Protective Coating Monitoring and Maintenance Program
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring
- TLAA
- Water Chemistry

LRA Tables 3.5.2-1 through 3.5.2-14 summarize the AMR results for the Structures and Component Supports components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report; however, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.5.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.5.1, items 3.5.1-25 and 3.5.1-89, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.5.1, items 3.5.1-15 through 3.5.1-18, 3.5.1-23, 3.5.1-26, 3.5.1-27, 3.5.1-38 through 3.5.1-40, 3.5.1-62, 3.5.1-68, 3.5.1-69, 3.5.1-73, 3.5.1-76, 3.5.1-84, 3.5.1-86, and 3.5.1-94, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

For LRA Table 3.5.1 items discussed below, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable. For these items, the staff reviewed sources beyond the LRA and UFSAR or issued one or more RAIs, or both, in order to verify the applicant's claim of non-applicability.

LRA Table 3.5.1, item 3.5.1-16, addresses accessible concrete exposed to uncontrolled indoor air or outdoor air. The GALL Report recommends GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL," or AMP XI.S6, "Structures Monitoring," to manage increases in porosity and permeability, cracking, or loss of material due to aggressive chemical attack for this component group. The applicant stated that this item is not applicable because the Primary Containment is completely enclosed and is not exposed to an outdoor air environment. In addition, the indoor environment lacks aggressive chemicals that could contact the concrete. The staff evaluated the applicant's claim and noted that the indoor environment reduces the likelihood of this aging effect, but it does not agree that the indoor environment completely eliminates the possibility of the aging effect occurring. However, the staff also noted that this concrete is included within the applicant's ASME Section XI, Subsection IWL program, which conducts appropriate inspections for identifying this aging effect if it were to occur. Therefore, the staff finds this item acceptable because the environment reduces the chances of this aging effect occurring and because the concrete is within the scope of an AMP that would identify the aging effect if it were to occur.

LRA Table 3.5.1, item 3.5.1-27, addresses steel, stainless steel, and dissimilar metal welds exposed to air-indoor, uncontrolled, or treated water. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J," to manage cracking due to cyclic loading for components for which a CLB fatigue analysis does not exist. The applicant stated that this item is not applicable because LSCS does have a CLB fatigue analysis associated with penetration sleeves and downcomers; therefore, this aging effect and mechanism is addressed under item 3.5.1-9. The staff evaluated the applicant's claim and finds it acceptable because this item only applies to components that do not have a fatigue-based analysis in the CLB. The applicant addresses the containment liner and penetration sleeve, refueling bellows, and downcomers (i.e., components that have a fatigue analysis in the CLB) as a TLAA. The staff's evaluation of the TLAA to address these components is documented in SER Section 4.6.

LRA Table 3.5.1, item 3.5.1-36, addresses the steel elements of the drywell head and the downcomers exposed to an uncontrolled indoor air environment. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," to manage fretting or lockup due to mechanical wear for this component group. The applicant stated that this item will be managed by the ASME Section XI, Subsection IWE program for the steel elements of the drywell head, which aligns with the GALL recommendation. The applicant further stated that the portion of the item associated with the downcomers does not apply to the LSCS Mark II containment design. The staff evaluated the applicant's claim and finds it acceptable because the LSCS downcomers are stainless steel, whereas the GALL Report items only apply to steel components, and the downcomers are anchored in the drywell floor, which prevents relative motion and precludes mechanical wear.

LRA Table 3.5.1, item 3.5.1-38, addresses the stainless steel suppression chamber liner exposed to an uncontrolled indoor air environment. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J," to manage cracking due to SCC for this component group. The applicant stated that this item is not applicable because this item is only applicable to Mark III containments and LCSC is a Mark II containment design. The staff evaluated the applicant's claim and finds it acceptable because all of the GALL Report items associated with SRP-LR Table 3.5.1, item 3.5.1-38, address Mark III containments. Item 3.5.1-37 addresses the aging management of the stainless steel suppression chamber liner for Mark II containments.

LRA Table 3.5.1, item 3.5.1-40, addresses steel elements, including vent header and downcomers exposed to air-indoor, uncontrolled, or treated water. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J," to manage cracking due to cyclic loading for components for which a CLB fatigue analysis does not exist. The applicant stated that this item is not applicable because LSCS has braced downcomers and because a CLB fatigue analysis does exist for the downcomers. The staff evaluated the applicant's claim and finds it acceptable because this item only applies to components that do not have a fatigue-based analysis in the CLB. The applicant addresses cyclic loading for downcomers as a TLAA. The staff's evaluation of the TLAA to address these components is documented in SER Section 4.6. The applicant also stated that the LSCS primary containment design does not use a vent line header. The staff reviewed UFSAR Section 3.8 and noted that LSCS does not use a torus and/or torus vent line for pressure suppression and, therefore, does not have a corresponding vent line header. Therefore, the staff finds that the determination that the item is not applicable is acceptable.

3.5.2.1.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-37, addresses stainless steel components of the containment suppression chamber exposed to uncontrolled indoor air and/or treated water environments, which will be managed for loss of material due to corrosion. For the AMR items in LRA Table 3.5.2-7 that cite generic note E and plant-specific note 5, the LRA credits the ASME Section XI, Subsection IWE program to manage the aging effect for the drywell floor liner, the cavity slab liner, the drywell floor penetrations, and the downcomers. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J," to ensure that this aging effect is adequately managed. The GALL Report AMPs recommend using visual inspections and 10 CFR Part 50, Appendix J, pressure testing to manage the effects of aging.

The staff's evaluation of the applicant's ASME Section XI, Subsection IWE program is documented in SER Section 3.0.3.2.15. The staff noted that the applicant's ASME Section XI, Subsection IWE program proposes to manage the effects of aging for stainless steel components through the use of acceptable visual inspections. LRA Table 3.5.2-7 plant-specific note 5 states, in part, that "10 CFR 50 Appendix J pressure testing is not applicable to the drywell floor liner, cavity slab liner, drywell floor penetrations, downcomers, and pedestal liner." The staff noted that these components are not required to be within the scope of the 10 CFR Part 50, Appendix J program and that pressure testing would not be an appropriate aging management approach for these items because they are not primary containment pressure-retaining components. Based on its review of components associated with item 3.5.1-37 for which the applicant cited generic note E and plant-specific note 5, the staff finds the applicant's proposal to manage the effects of aging using only the ASME Section XI, Subsection IWE program acceptable because the program includes appropriate visual inspections and because the additional pressure testing recommended by the 10 CFR Part 50, Appendix J program would be ineffective for detecting degradation in these components.

LRA Table 3.5.1, item 3.5.1-37, addresses stainless steel liners of concrete columns in the containment suppression chamber exposed to uncontrolled indoor air and/or treated water environments, which will be managed for loss of material due to corrosion. For the AMR items in LRA Table 3.5.2-7 that cite generic note E and plant-specific note 8, the LRA credits the Structures Monitoring program to manage the aging effect for the non-pressure-retaining liners of the concrete columns. The GALL Report recommends GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J," to ensure that this aging effect is adequately managed. The GALL Report AMPs recommend using visual inspections and 10 CFR Part 50, Appendix J pressure testing to manage the effects of aging.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.19. The staff noted that the applicant's Structures Monitoring program proposes to manage the effects of aging for stainless steel components through the use of acceptable visual inspections. The staff noted that the referenced components are not required to be within the scope of the ASME Section XI, Subsection IWE or 10 CFR Part 50, Appendix J programs because they are not primary containment pressure-retaining components. Furthermore, pressure testing would not be an effective aging management technique for these items because they are not pressure-retaining components. Based on its review of components associated with item 3.5.1-37, for which the applicant cited generic note E and plant-specific note 8, the staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the program includes appropriate visual inspections.

The staff concludes that, for LRA item 3.5.1-37, the applicant has demonstrated that the effects of aging for these components 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).

LRA Table 3.5.1, item 3.5.1-80, addresses steel structural bolting exposed to air-indoor uncontrolled environment, which will be managed for loss of material due to general, pitting, and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program to manage the aging effect for bolting in cranes, hoists, and refueling equipment systems and the ASME Section XI, Subsection IWL program to manage the aging effect for steel grease cap at tendon anchorage. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using visual inspections at a frequency not to exceed 5 years to manage the effects of aging. GALL Report AMP XI.S6 states that other structural bolting and anchor bolts are monitored for loss of material, loose or missing nuts, and cracking of concrete around the anchor bolts.

The staff's evaluation of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program and ASME Section XI, Subsection IWL program are documented in SER Sections 3.0.3.2.7 and 3.0.3.2.16, respectively. The staff noted that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program proposes to manage the effects of aging loss of material due to corrosion for associated bolted connections through the use of periodic visual inspections (Commitment No. 14). The staff also noted that the ASME Section XI, Subsection IWL program proposes to manage the effects of aging for the unbonded post-tensioning system through the use of visual inspections at 5-year intervals. The staff reviewed UFSAR Section 3.8.1.7.3.1 and verified that tendon anchorage hardware and grease caps are visually inspected for compliance with ASME Section XI, Subsection IWL. The staff notes that paragraph IWL-2524.1(b) of ASME Code Section XI, Subsection IWL, requires an examination of tendon anchorage hardware for corrosion, broken or protruding wires, missing buttonheads, broken strands, and cracks. Based on its review of components associated with item 3.5.1-80 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program and the ASME Section XI, Subsection IWL program acceptable because the AMPs use periodic visual examination to detect loss of material due to corrosion before the loss of intended functions, consistent with the GALL Report recommendations.

The staff concludes that, for LRA item 3.5.1-80, the applicant has demonstrated that the effects of aging for these components 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).

3.5.2.1.3 Loss of Sealing Due to Deterioration of Seals, Gaskets, and Moisture Barriers (Caulking, Flashing, and Other Sealants)

LRA Table 3.5.1, item 3.5.1-72 addresses seals, gasket, and moisture barriers (caulking, flashing, and other sealants) exposed to various environments, which will be managed for loss of sealing due to deterioration. For the AMR items that cite generic note E, the LRA credits the Aboveground Metallic Tanks program to manage the aging effect for elastomer sealants and moisture barriers in tank foundations and dikes and the ASME Section XI, Subsection IWL program to manage the aging effect for elastomeric gaskets for grease caps at prestressing tendon anchorages. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using visual inspections at a frequency not to exceed 5 years to manage the effects of aging.

The staff's evaluation of the applicant's Aboveground Metallic Tanks program and ASME Section XI, Subsection IWL program are documented in SER Sections 3.0.3.2.11 and 3.0.3.2.16, respectively. The staff noted that the Aboveground Metallic Tanks program, as revised by the applicant's response to RAI B.2.1.18-2, dated August 6, 2015, proposes to manage the effects of aging loss of sealing for caulking at the perimeter of the cycled condensate storage tank bases through the use of periodic visual inspections supplemented with physical manipulation for the caulking (Commitment No. 18, item 4). The staff also noted that the ASME Section XI, Subsection IWL program proposes to manage the effects of aging for unbonded post-tensioning systems through the use of visual inspections at 5-year intervals. The staff reviewed UFSAR Section 3.8.1.7.3.1 and verified that tendon anchorage hardware and grease caps are visually inspected for compliance with ASME Section XI, Subsection IWL. The staff notes that paragraph IWL-2510(c) in ASME Code Section XI, Subsection IWL, requires an examination of the concrete surfaces and tendon end anchorage areas for corrosion protection medium leakage and an examination of the tendon end caps for deformation. Based on its review of components associated with item 3.5.1-72 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Aboveground Metallic Tanks program and the ASME Section XI, Subsection IWL program acceptable because the AMPs use periodic visual examination to detect loss of sealing and leakage before the loss of intended functions, consistent with the GALL Report recommendations.

The staff concludes that, for LRA item 3.5.1-72, 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).

3.5.2.1.4 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-78, addresses steel components for the fuel pool liner exposed to treated water, which will be managed for cracking due to SCC and for loss of material. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from leak chase channels to ensure that this aging effect is adequately managed.

During its review of components associated with item 3.5.1-78 for which the applicant cited generic note B, the staff noted that the LRA credits the Water Chemistry program to manage the aging effect for loss of material and cracking of stainless steel components of the fuel pool liner and additional components, such as stainless steel gates, liner anchors, and integral attachments. However, LRA Table 3.5.2-9 does not address cracking for stainless steel components exposed to treated water that are associated with item 3.5.1-78. The staff recognizes that treated water less than 140 °F is not an environment that is conducive to SCC; however, the UFSAR states that the spent fuel pool can exceed 140 °F. By letter dated July 27, 2015, the staff issued RAI 3.5.1.78-1, requesting that the applicant justify why the spent fuel pool components were not being managed for cracking.

In its response dated August 26, 2015, the applicant stated that it reviewed spent fuel pool temperatures since January 2000 and confirmed that temperatures have been maintained well below 140 °F, with the highest recorded temperature at less than 114 °F and the average normal temperature at 95 °F. The applicant discussed the portions of SRP-LR Section A.1.2.1.7 that state that aging effects from abnormal events need not be postulated unless such an event has occurred at the particular plant. The applicant stated that the discussion in the UFSAR relating to spent fuel pool temperatures above 140 °F is only applicable for an "emergency" full core offload and that no such offload has occurred nor is it expected to occur. Based on this, the applicant determined that cracking was not an AERM for items that reference item 3.5.1-78; consequently, no clarification on how the effectiveness of the Water Chemistry program is being verified is necessary.

The staff finds the response acceptable because the applicant verified that spent fuel pool temperatures have not exceed the 140 °F criterion and because it is reasonable to consider the temperatures discussed in the UFSAR for an "emergency" full core offload as an abnormal event that does not need to be postulated. The staff's concern described in RAI 3.5.1.78-1 is resolved.

The staff concludes that, for LRA item 3.5.1-78, 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).

3.5.2.1.5 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-85, addresses stainless steel structural bolting exposed to treated water, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR item that cites generic note E, the LRA credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program in LRA Section B.2.1.14 and the Water Chemistry program in LRA Section B.2.1.2 to manage the aging effect of loss of material due to corrosion for stainless steel structural bolting. The GALL Report recommends GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF," and AMP XI.M2, "Water Chemistry," to ensure that this aging effect is adequately managed. GALL Report AMP XI.S3 recommends using VT-3 visual inspections on a prescribed sample of supports at an interval of 10 years to manage the effects of aging.

The staff's evaluation of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program and the Water Chemistry program is documented in SER Sections 3.0.3.2.7 and 3.0.3.2.1, respectively. Because both the LRA and GALL Report AMR items use the Water Chemistry program as one of the AMPs to manage the aging effect, the acceptability of the use of the Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program in lieu of the ASME Section XI, Subsection IWF program as the other AMP to manage the aging effect is only discussed here. The staff noted that the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, with enhancement, is consistent with GALL Report AMP XI.M23.

The staff also noted that the enhanced Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program proposes to manage the effects of aging of loss of material due to corrosion for components under its scope, including stainless steel bolting in cranes, hoists, and refueling equipment through the use of periodic visual inspections by qualified personnel and at a frequency consistent with the recommendations of the ASME Code B30 series standards for all cranes, hoists, and handling equipment systems. Accordingly, periodic inspections are performed annually. For handling systems that are infrequently in service, such as those only used during refueling outages, periodic inspections may be deferred until just prior to use.

Based on its review of components associated with item 3.5.1-85 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable because (1) the enhanced program includes, under its scope, the aging effect of loss of material due to corrosion of stainless steel bolting in a treated water environment and (2) the program includes periodic visual inspections using qualified personnel annually or at least just before use to detect loss of material on cranes and/or hoist components, including bolting, which is more frequent than visual inspections in the GALL Report-recommended AMP XI.S3 and, therefore, is at least as effective in managing the aging effect.

The staff concludes that, for LRA item 3.5.1-85, 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).

LRA Table 3.5.1, item 3.5.1-93 addresses support members, welds, bolted connections, and support anchorage to building structures exposed to an air-outdoor environment, which will be managed for loss of material due to pitting and crevice corrosion. For the AMR item that cites generic note E, the LRA credits the Open-Cycle Cooling Water System program to manage the aging effect for stainless steel shad net fish barrier filters in the Essential Cooling Water System. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using visual inspections at a frequency not to exceed 5 years to manage the effects of aging.

The staff's evaluation of the applicant's Open-Cycle Cooling Water System program is documented in SER Section 3.0.3.2.5. The staff noted that the Open-Cycle Cooling Water System program proposes to manage the effects of aging, loss of material, and reduction of heat transfer for heat exchangers, piping, piping elements, and piping components in safety-related and nonsafety-related systems. The staff also noted that the AMP manages the effects of aging through the use of visual inspections, testing, nondestructive examinations, and biocide and chemical treatment. LRA Section B.2.1.12 states that activities for this program are consistent with commitments to the requirements of GL 89-13, which recommends visual inspection at a frequency of once per refueling cycle for intake structures. Also, as documented in the Open-Cycle Cooling Water System program Audit Report, polymeric portions of the shad net are periodically replaced, providing other opportunities for inspections. Based on its review of components associated with item 3.5.1-93 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Open-Cycle Cooling Water System program acceptable because the AMP uses periodic visual examination, at a frequency not to exceed 5 years, to detect loss of material before the loss of intended functions, consistent with the GALL Report recommendations.

The staff concludes that, for LRA item 3.5.1-93, 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).

3.5.2.1.6 Loss of Preload Due to Self-Loosening

LRA Table 3.5.1, item 3.5.1-88, addresses steel structural bolting exposed to any environment, which will be managed for loss of preload due to self-loosening. For the AMR items that cite generic note E, the LRA credits the Inspection of Overhead Heavy Load and Light Load

(Related to Refueling) Handling Systems program to manage the aging effect for steel bolting in cranes, hoists, and refueling equipment and the ASME Section XI, Subsection IWL program to manage the aging effect for grease caps in tendon anchorage. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to ensure that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using visual inspections at a frequency not to exceed 5 years to manage the effects of aging. GALL Report AMP XI.S6 states that structural bolting is monitored for loose bolts, missing or loose nuts, and other conditions indicative of loss of preload.

The staff's evaluation of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program and the ASME Section XI, Subsection IWL program are documented in SER Sections 3.0.3.2.7 and 3.0.3.2.16, respectively. The staff noted that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program proposes to manage the effects of aging loss of preload for associated bolted connections through the use of periodic visual inspections (LRA Commitment No. 14). Per LRA Section B.2.1.14, inspections are performed annually or just before use.

The staff also noted that the ASME Section XI, Subsection IWL program proposes to manage the effects of aging for unbonded post-tensioning system through the use of visual inspections at 5-year intervals. The staff reviewed UFSAR Section 3.8.1.7.3.1 and verified that tendon anchorage hardware and grease caps are visually inspected for compliance with ASME Code Section XI, Subsection IWL. The staff notes that paragraph IWL-2524.1 of ASME Code Section XI, Subsection IWL, requires the tendon anchorage hardware to be examined, in part, for corrosion, broken or protruding wires, missing buttonheads, broken strands, cracks, and detached buttonheads. Based on its review of components associated with items 3.5.1-88 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program and the ASME Section XI, Subsection IWL program acceptable because the AMPs use periodic visual examination to detect conditions indicative of loss of preload before the loss of intended functions, consistent with the GALL Report recommendations.

The staff concludes that, for LRA item 3.5.1-88, 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).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation Is Recommended

In LRA Section 3.5.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the structures and component supports components and provided information concerning how it will manage aging effects in the following four areas:

(1) PWR and BWR containments

- cracking and distortion due to increased stress levels from settlement, reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations
- reduction of strength and modulus 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
- loss of material (scaling, spalling) and cracking due to freeze-thaw
- cracking due to expansion and reaction with aggregates
- increase in porosity and permeability due to leaching of calcium hydroxide and carbonation

(2) safety-related and other structures and component supports

- aging management of inaccessible areas
- reduction of strength and modulus 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
- cumulative fatigue damage due to fatigue

(3) QA for aging management of nonsafety-related components

(4) ongoing review of operating experience

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 and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which address the following areas:

Cracking and Distortion Due to Increased Stress Levels from Settlement, Reduction of Foundation Strength, and Cracking Due to Differential Settlement and Erosion of Porous Concrete Subfoundations. LRA Section 3.5.2.2.1.1, associated with LRA Table 3.5.1, item 3.5.1-1, addresses cracking and distortion due to increased stress levels from settlement in the concrete dome, wall, basemat, ring girders, and buttresses exposed to soil. LRA Section 3.5.2.2.1.1 is also associated with LRA Table 3.5.1, item 3.5.1-2, which addresses reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation in concrete foundation and subfoundation exposed to flowing water. The criteria in SRP-LR Section 3.5.2.2.1.1 state that for PWR and BWR containments the GALL Report recommends further evaluation for aging management of (1) cracking and distortion due to settlement and (2) reduction of foundation strength and cracking, if a dewatering system is used to control settlement. The SRP-LR also states that, when a dewatering system used to control settlement is in place, its functionality should be monitored through the ASME Section XI, Subsection IWL program or the Structures Monitoring program.

The applicant addressed the further evaluation criteria of the SRP-LR by stating that the LSCS primary containment structures are founded on soil and, therefore, could be subject to cracking and distortion due to increased stress levels from settlement. The applicant stated that, although cracking and distortion have not been observed in LSCS concrete structures, the ASME Section XI, Subsection IWL and Structures Monitoring programs include provisions to monitor the primary containment structures for cracking. The applicant further stated that it would use indications from above-grade portions of the containment building and the enclosing reactor building to detect cracking of below-grade areas. In addition, the applicant stated that cracks extending into accessible areas, including buttresses of the Primary Containment, if any, would be managed by the ASME Section XI, Subsection IWL program. The applicant stated that procedures require an extent of condition evaluation and additional inspections or evaluations to address inaccessible and below-grade portions of the structure. In addition, the applicant stated that it does not rely on a dewatering system to control settlement.

The staff's evaluation of the applicant's ASME Section XI, Subsection IWL and Structures Monitoring programs are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.19, respectively. The staff noted that this item is associated with GALL Report item II.B2.2.CP-105, which recommends that these programs be used to manage aging of accessible and inaccessible areas of the containment concrete. The staff also noted that both programs use periodic visual inspections and that these visual inspections identify cracking due to any mechanism. The programs include provisions for evaluation of inaccessible areas if indications of degradation are found in accessible areas of structural concrete.

In its review of components associated with item 3.5.1-1, the staff finds that the applicant has met the further evaluation criteria and finds the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL and Structures Monitoring programs acceptable because (1) the applicant has no operating experience to indicate that there has been settlement cracking of primary containment to date, (2) the applicant will manage cracking due to distortion and settlement using accessible areas as indicators of degradation to drive evaluation of inaccessible areas, and any cracking that would affect the ability of primary containment to perform its safety functions would propagate to areas of the containment that are accessible and are subject to periodic visual examinations before a loss of those safety functions occurs, and (3) no additional actions or evaluations are necessary to manage the function of a dewatering system to control settlement because the applicant does not control settlement with such a system.

For item 3.5.1-2, the applicant stated that this item is not applicable because LSCS containments do not have any porous concrete subfoundations; therefore, this aging effect and mechanism is not applicable. The staff evaluated the applicant's claim and finds it acceptable because the GALL Report recommendation to manage the aging effect of reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation only applies to porous subfoundations, which do not exist at LSCS.

<u>Reduction of Strength and Modulus Due to Elevated Temperature</u>. LRA Section 3.5.2.2.1.2, associated with LRA Table 3.5.1, item 3.5.1-3, addresses reduction of strength and modulus of concrete due to elevated temperatures in concrete, including the dome, wall, basemat, ring girders, buttresses, containment, and fill-in annulus exposed to an air-indoor uncontrolled or air-outdoor environment. The criteria in SRP-LR Section 3.5.2.2.1.2 state that the GALL Report recommends further evaluation of a plant-specific program if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature greater than 150 °F and local area temperature greater than 200 °F). The SRP-LR also states

that the implementation of 10 CFR 50.55a and the ASME Section XI, Subsection IWL program would not be able to identify this aging effect; however, higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and if these reductions are applied to the design calculations. The applicant stated that this item is not applicable because (1) the average temperature inside the primary containment structure is maintained less than 135 °F by the primary containment ventilation system in accordance with LSCS Technical Specification limits, (2) a cooling coil system is used between hot pipes and primary containment penetration sleeves as an added feature to reduce local concrete temperatures, and (3) localized concrete temperatures exceeding 200 °F have not been reported. The staff evaluated the applicant's claim and finds it acceptable because the staff reviewed UFSAR Subsections 6.2.1.1.2, 7.8.2.2.2.4, and 3.8.1.1.3.5.2 and confirmed that (1) a primary containment ventilation system maintains the general area temperatures below the threshold from the GALL Report, (2) the design of the primary containment penetration sleeves provides insulation, air gaps, and a cooling coil system to reduce thermal stress in the containment during normal operations, and (3) site operating experiences have not identify plant conditions in which local area temperatures have exceeded the threshold limit in the GALL Report.

Loss of Material Due to General, Pitting, and Crevice Corrosion.

Item 1. LRA Section 3.5.2.2.1.3 is associated with LRA Table 3.5.1, items 3.5.1-4 and 3.5.1-5. Item 3.5.1-4 addresses steel elements (inaccessible areas), including a steel drywell shell and drywell head exposed to air-indoor, uncontrolled, or concrete. This item is associated with Mark III containments and is not applicable to LSCS, which uses a Mark II containment design. Item 3.5.1-5 addresses steel elements (inaccessible areas), including a drywell liner, liner anchors, integral attachments, and the region shielded by the diaphragm floor exposed to an air-indoor uncontrolled environment, which will be managed for loss of material by the 10 CFR Part 50, Appendix J and ASME Section XI, Subsection IWE programs. The LRA states that the LSCS suppression chamber is lined with stainless steel; therefore, it is not applicable to this item. The criteria in SRP-LR Section 3.5.2.2.1.3, item 1, state that loss of material due to general, pitting, and crevice corrosion could occur for steel elements of inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage this aging effect if corrosion is indicated from the IWE examinations.

The applicant addressed the further evaluation criteria of the SRP-LR by stating that the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program will be used to manage loss of material of steel elements in inaccessible areas of the drywell and integral attachments. The applicant stated several ways that the configuration of the LSCS containment is such that there are few inaccessible areas for which steel corrosion could be an issue. The LRA states that the LSCS concrete containment drywell and suppression pool design does not use a liner that is inaccessible for inspection and that the majority of the IWE surfaces, including the drywell head, is accessible. There is no air gap between the drywell liner and the concrete containment. Additionally, corrosive materials, such as borated water or brackish service water, do not come into contact with the containment. The LRA states that "[t]here are limited areas that are inaccessible for inspection which include the thickened embedded steel section covered by the outer edges of the concrete drywell floor, and also the suppression pool floor liner areas covered by the suppression pool columns and areas behind the suction strainers." The applicant stated that the concrete drywell floor, which is inspected as part of the ASME Section XI, Subsection IWL program, has not shown any indication of cracking near the junction of the concrete and liner and has not shown cracking of the concrete floor or any indication of corrosion in the inaccessible portion of the liner. The suppression chamber walls, floor, and ceiling are lined with stainless steel, and the applicant noted that no signs of general, pitting, and crevice corrosion have been indicated from IWE examinations of these areas. The LRA states that the coated areas of the carbon steel liner are inspected for indications, such as blisters, that could indicate corrosion of the drywell liner. The applicant stated that areas of light general corrosion have been identified in the drywell during IWE examinations but that the corrosion has not been significant. These areas have been recoated or identified for coating maintenance. The applicant concluded that no additional plant-specific activities are warranted to manage loss of material due to general, pitting, and crevice corrosion for inaccessible steel areas of containment and that the continued monitoring of the containment liner in accordance with the ASME Section XI, Subsection IWE and 10 CFR Part 50 Appendix J programs will provide reasonable assurance that the containment liner will remain functional through the period of extended operation.

The staff notes that the applicant's operating experience and IWE inspections suggest that there is no significant loss of material of the LSCS containment liner due to general, pitting, or crevice corrosion in accessible and inaccessible areas to necessitate a plant-specific program to manage the aging effect. The staff's evaluation of the applicant's ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program are documented in SER Sections 3.0.3.2.15 and 3.0.3.1.15, respectively. The staff noted that the programs ensure that corrosion of the carbon steel containment liner and components is detected and that corrective actions are taken before there is a loss of material that affects its ability to perform intended functions by using visual examinations of all accessible drywell and suppression chamber areas. These inspections are performed at frequencies required by ASME Code Section XI, Subsection IWE, and applicable regulations, and periodic leak rate testing is performed in accordance with 10 CFR Part 50, Appendix J. Augmented examinations, including examinations of inaccessible areas, are required if there are indications in accessible areas that degradation of inaccessible areas could also be occurring. The staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program is acceptable because the plant-specific operating experience from IWE examinations indicates no significant loss of material due to corrosion in inaccessible areas of the containment and because the applicant's approach to managing the aging effect is consistent with the recommendations in GALL Report item II.B2.2.CP-63, which corresponds to LRA Table 3.5.1, item 3.5.1-5.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.5.2.2.1.3, item 1, criteria. The staff concludes 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).

Item 2. LRA Section 3.5.2.2.1.3.2, associated with LRA Table 3.5.1, item 3.5.1-6, addresses steel elements, including the torus shell exposed to an air-indoor, uncontrolled, or treated water environment, which will be managed for loss of material due to general, pitting, and crevice corrosion by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs. The criteria in SRP-LR Section 3.5.2.2.1.3, item 2, state that loss of material due to general, pitting, and crevice corrosion could occur in steel torus shell of Mark I containments. LSCS uses a Mark II concrete containment where the primary containment drywell is steel-lined prestressed concrete and the suppression pool is stainless steel lined prestressed concrete; therefore, this item is not applicable for LSCS.

Item 3. LRA Section 3.5.2.2.1.3.3, associated with LRA Table 3.5.1, item 3.5.1-7, addresses steel elements, including torus ring girders, downcomers, suppression chamber shell (interior surface) exposed to an air-indoor, uncontrolled, or treated water environment, which will be managed for loss of material due to general, pitting, and crevice corrosion by the ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J programs. The criteria in SRP-LR Section 3.5.2.2.1.3, item 3, state that loss of material due to general, pitting, and crevice corrosion could occur in the steel torus ring girders and downcomers of Mark I containments, downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments. The SRP-LR also states that the existing program relies on the ASME Section XI, Subsection IWE program to manage this aging effect. The applicant stated that this item is not applicable to the LSCS Mark II concrete containment because LSCS uses stainless steel, not carbon steel, downcomers. The applicant stated that general, pitting, and crevice corrosion have not been identified from the IWE examinations of the downcomers and that the ASME Section XI, Subsection IWE program is used to manage loss of material of these components. The staff reviewed sections of the UFSAR, including Table 6.1-1, and verified that the downcomers are stainless steel. Therefore, the staff finds that this item, which is associated with further evaluation of carbon steel containment components, does not apply to LSCS. Further, the staff noted that the stainless steel downcomers are managed by the ASME Section XI, Subsection IWE program for this aging effect under LRA Table 3.5.1, item 3.5.1-37.

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. LRA Section 3.5.2.2.1.4, associated with LRA Table 3.5.1, item 3.5.1-8, states that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for the prestressed concrete primary containment structures is an aging effect evaluated by a TLAA in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in LRA Section 4.5. This is consistent with SRP-LR Section 3.5.2.2.1.4 and, therefore, is acceptable. The staff's evaluation of the TLAA for concrete containment tendon prestress analyses is documented in SER Section 4.5.

Cumulative Fatigue Damage. LRA Section 3.5.2.2.1.5, associated with LRA Table 3.5.1, item 3.5.1-9, addresses penetration sleeves, penetration bellows, torus and vent header steel elements, vent line, vent header, vent line bellows, downcomers, suppression pool shell, unbraced downcomers, and downcomers exposed to either an air-indoor uncontrolled or treated water environment, which will be managed for cumulative fatigue damage by the TLAAs. The criteria in SRP-LR Section 3.5.2.2.1.5 state that fatigue analyses included in the CLB are TLAAs as defined in 10 CFR 54.3, "Definitions," and that they are required to be evaluated in accordance with 10 CFR 54.21(c). The applicant stated that LSCS does not have penetration bellows, torus vent line, vent line header, vent line bellows, unbraced downcomers, or vent headers. The applicant addressed the further evaluation criteria of the SRP-LR by stating that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in LRA Section 4.6, "Primary Containment Fatigue Analyses." This is consistent with SRP-LR Section 3.5.2.2.1.5 and, therefore, is acceptable.

In its review of components associated with item 3.5.1-9, the staff noted that the corresponding LRA Table 3.5.2-7 AMR results items address electrical penetration assemblies, mechanical penetration assemblies, penetration sleeves, refueling bellows assembly, and downcomer components, which will be managed for cumulative fatigue damage aging effects by the TLAAs. However, the staff noted that LRA Table 3.5.2-7 does not identify any AMR results items corresponding to Table 3.5.1, item 3.5.1-9, for the primary containment liner. The LRA does not clarify how these components are being adequately managed for cumulative fatigue damage aging effects for the period of extended operation.

By letter dated July 27, 2015, the staff issued RAI 3.5.2.2.1.5-1, requesting that the applicant describe how the primary containment liner is adequately managed for the cumulative fatigue damage aging effect through the period of extended operation and provide the technical basis for not addressing containment liner components in the LRA Table 3.5.2-7 for AMR results.

In its response dated August 26, 2015, the applicant stated that the cumulative fatigue damage aging effect for primary containment components will be adequately managed through the period of extended operation by its Fatigue Monitoring program. The applicant revised LRA Table 3.5.2-7 and Section 3.5.2.2.1.5 to include the cumulative fatigue damage aging effect items for the primary containment liner and associated components.

The staff finds the applicant's response acceptable because the cumulative fatigue damage aging effect for the primary containment liner and associated components will be managed by the Fatigue Monitoring program based on disposition of the associated TLAA in LRA Section 4.6.1 pursuant to 10 CFR 54.21(c)(1)(iii) and because the applicant revised LRA Table 3.5.2-7 to identify the AMR results items associated with this aging effect. The staff's concern described in RAI 3.5.2.2.1.5-1 is resolved.

The staff's evaluation of the applicant's TLAAs for the primary containment liner and penetrations, refueling bellows, and downcomer vents are documented in SER Sections 4.6.1, 4.6.2, and 4.6.3, respectively. The staff notes that the aging effects for containment liner and penetrations will be managed using the Fatigue Monitoring program through the period of extended operation. The staff finds that the applicant has met the further evaluation criteria and that the applicant's plan to manage the effects of aging using TLAAs and the Fatigue Monitoring program is acceptable because the required TLAAs have been evaluated in accordance with 10 CFR 54.21(c)(1).

For those items associated with LRA Section 3.5.2.2.1.5, the staff concludes 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).

Cracking Due to Stress Corrosion Cracking. LRA Section 3.5.2.2.1.6, associated with LRA Table 3.5.1, item 3.5.1-10, addresses cracking due to SCC in containment bellows and penetrations fabricated with stainless steel that are exposed to uncontrolled air-indoor (external) or treated water (internal). The acceptance criteria in SRP-LR Section 3.5.2.2.1.6 state that cracking due to SCC of stainless steel penetration bellows and dissimilar metal welds could occur in all types of PWR and BWR containments. The SRP-LR also states that the existing program relies on ASME Code Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. In addition, the SRP-LR states that the GALL Report recommends further evaluation of additional appropriate examinations or evaluations implemented to detect these aging effects for stainless steel penetration bellows and dissimilar metal welds.

LRA Section 3.5.2.2.1.6 states that the primary containment design does not use penetration bellows. The LRA also states that AMR item 3.5.1-10 is not applicable to the LSCS stainless steel penetration sleeves and dissimilar metal welds because the environment is not corrosive enough to cause SCC. The LRA further states that inspections of these stainless steel penetration components are conducted in accordance with the ASME Section XI, Subsection IWE program and the 10 CFR Part 50, Appendix J program. The LRA states that no further evaluation is required because LSCS and industry operating experience has not identified cracking due to SCC as an applicable aging effect for BWR Mark II containment stainless steel penetration components.

In its review, the staff finds the applicant's claim acceptable because (1) the LSCS units do not use containment penetration bellows, consistent with the staff's review of the UFSAR that did not identify any containment penetration bellows, (2) the plant-specific and industry operating experience has not identified cracking due to SCC of Mark II containment stainless steel penetration components, and (3) LSCS containment penetrations are not exposed to a corrosive environment that could cause SCC. The staff finds that the applicant's use of the existing ASME Section XI, Subsection IWE program and 10 CFR Part 50, Appendix J program is acceptable to ensure that cracking due to SCC does not affect the integrity of the stainless steel penetration components.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.5.2.2.1.6 criteria. For those items associated with LRA Section 3.5.2.2.1.6, the staff concludes 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).

<u>Loss of Material (Scaling, Spalling) and Cracking Due to Freeze-Thaw</u>. LRA Section 3.5.2.2.1.7, associated with LRA Table 3.5.1, item 3.5.1-11, addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in inaccessible areas of concrete, including the dome, wall, basemat, ring girders, and buttresses exposed to an air-outdoor or groundwater/soil environment. The criteria in SRP-LR Section 3.5.2.2.1.7 state that the GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions. The SRP-LR also states that a plant-specific program is not required if documented evidence confirms that the existing concrete has an air content of 3 to 8 percent and that subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant stated that this item is not applicable because the primary containment is completely enclosed and sheltered by the air-indoor environment of the reactor building (secondary containment); therefore, the primary containment is not subject to the freezing temperature environment necessary for this aging effect to occur. The staff evaluated the applicant's claim and finds it acceptable because the staff reviewed UFSAR Sections 3.8.1.1.1, 3.8.4.1.1, and 3.8.5.1.1 and confirmed that the primary containment is enclosed by the reactor building; therefore, these concrete elements are not exposed to the environment required for this aging effect to occur. The staff notes that this aging effect for inaccessible below-grade areas of the common basemat foundation is addressed by LRA Table 3.5.1, item 3.5.1-42, and SER Section 3.5.2.2.2, item 1.

<u>Cracking Due to Expansion and Reaction with Aggregates</u>. LRA Section 3.5.2.2.1.8, associated with LRA Table 3.5.1, item 3.5.1-12, addresses inaccessible areas of concrete elements exposed to an air-indoor uncontrolled or groundwater/soil environment, which will be managed for cracking due to expansion from reaction with aggregates by the ASME Section XI, Subsection IWL program and the Structures Monitoring program. The criteria in SRP-LR Section 3.5.2.2.1.8 state that the GALL Report recommends further evaluation to determine whether a plant-specific AMP is required to manage this aging effect. The GALL Report states that a plant-specific AMP is not necessary if (1) investigations, tests, and petrographic

examinations of aggregates performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within concrete or (2) for potentially reactive aggregates, aggregate concrete reaction is not significant if the structure was constructed in accordance with ACI 318. The applicant addressed the further evaluation criteria of the SRP-LR by stating that (1) petrographic examinations of aggregates and ASTM reactivity tests were performed in accordance with ASTM C227 at the time of construction to prevent use of reactive aggregates in concrete, (2) concrete structures were constructed in accordance with ACI 318 per UFSAR Appendix E, and (3) previous ASME Section XI, Subsection IWL program examinations have not identified the pattern cracking typical of expansion from reaction with aggregates in the primary containment or in accessible areas of the reactor building or other structures exposed to sources of moisture. Noting that NRC IN 2011-20, "Concrete Degradation by Alkali-Silica Reaction," dated November 18, 2011, indicates that the ASTM tests may not always be effective in screening reactive aggregates, the applicant further stated that the ASME Section XI, Subsection IWL program will continue to monitor the primary containment concrete for cracking and pattern cracking typical of expansion from reaction with aggregates or from cracking due to any mechanism and that the Structures Monitoring program will also examine exposed portions of below-grade concrete when it is excavated for any reason.

The staff's evaluation of the applicant's ASME Section XI, Subsection IWL program and Structures Monitoring program are documented in SER Sections 3.0.3.2.16 and 3.0.3.2.19, respectively. In its review of components associated with item 3.5.1-12, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the ASME Section XI, Subsection IWL program and the Structures Monitoring program is acceptable because (1) the staff reviewed Section E.1 of UFSAR Appendix E and confirmed that concrete structures were constructed in accordance with ACI 318-71, (2) site operating experience has not identified degradation due to expansion from reaction with aggregates, and (3) ongoing periodic visual inspections by the ASME Section XI, Subsection IWL program and the Structures Monitoring program to detect cracking patterns typical for this aging mechanism in accessible areas and from exposed portions of below-grade concrete, when it is excavated for any reason, will require the evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or could result in, degradation to such inaccessible areas.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.1.8 criteria. For those items associated with LRA Section 3.5.2.2.1.8, the staff concludes 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).

<u>Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide and Carbonation</u>. LRA Section 3.5.2.2.1.9, associated with LRA Table 3.5.1, items 3.5.1-13 and 3.5.1-14, addresses inaccessible areas of concrete, including a wall, basemat, and buttress exposed to a water-flowing environment, which will be managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation by the Structures Monitoring program. The criteria in SRP-LR Section 3.5.2.2.1.9 state that the GALL Report recommends further evaluation if leaching is observed in accessible areas that impact the intended functions. The GALL Report states that a plant-specific AMP is not required if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation or (2) an evaluation determined that the observed leaching of calcium hydroxide

and carbonation in accessible areas has no impact on the intended function of the concrete structure. The applicant addressed the further evaluation criteria of the SRP-LR by stating that no leaching has been observed in accessible areas of the primary containment that could have an impact on the intended function.

The applicant stated that item 3.5.1-13 is not applicable because the corresponding GALL Report items are not associated with the applicant's BWR Mark II concrete containment structure type. The staff reviewed UFSAR Section 1.1 and confirmed that the applicant's primary containments are designed as a BWR Mark II concrete containment. The staff evaluated the applicant's claim and finds it acceptable because this aging effect is applicable to PWR steel containments, Mark II steel containments, or Mark III concrete containments in accordance with the GALL Report recommendations and because LSCS primary containments are a BWR Mark II concrete containment structure type.

The applicant stated that item 3.5.1-14 is applicable to the concrete wall, basemat, and buttresses in inaccessible areas of the Mark II primary containment exposed to a water-flowing environment. The applicant stated that LSCS has not observed any indication of significant leaching in accessible areas of the primary containment wall or basemat that could impact intended functions; therefore, a plant-specific program is not necessary.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.19. The staff noted that the Structures Monitoring program is enhanced (license renewal Commitment No. 34, item 6) to include the monitoring for increase in porosity and permeability in concrete structures. The staff also noted that items in LRA Table 3.5.2-7, associated with Table 1 item 3.5.1-20, addresses the accessible areas of concrete for this component, which will be managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation by the ASME Section XI, Subsection IWL program. The staff notes that a plant-specific AMP is unnecessary because the LSCS operating experience did not identify any leaching in accessible areas of the primary containment that could have a significant impact on the intended function. In its review of components associated with item 3.5.1-14, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because periodic visual inspections by qualified personnel will detect indications of leaching and carbonation in accessible areas and because either the Structures Monitoring program or the ASME Section XI, Subsection IWL program will require the evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or could result in, degradation to such inaccessible areas.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.5.2.2.1.9 criteria. For those items associated with LRA Section 3.5.2.2.1.9, the staff concludes 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).

3.5.2.2.2 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 address the following areas:

Aging Management of Inaccessible Areas. The staff reviewed LRA Section 3.5.2.2.2.1, which addresses further evaluations recommended by SRP-LR Section 3.5.2.2.2.1 related to aging management of below-grade inaccessible areas of Groups 1 through 3, 5, and 7 through 9 structures for aging effects as discussed below.

Item 1. LRA Section 3.5.2.2.2.1.1, associated with LRA Table 3.5.1, item 3.5.1-42, addresses below-grade inaccessible concrete areas of Groups 1 through 3 structures exposed to an air-outdoor environment for plants located in moderate to severe weathering conditions, which will be managed for loss of material (spalling, scaling) and cracking due to freeze-thaw by the Structures Monitoring program. The LRA states that LSCS does not have Groups 5 and 7 through 9 structures with concrete inaccessible areas exposed to this environment. The criteria in SRP-LR Section 3.5.2.2.2.1, item 1, state that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur for below-grade inaccessible concrete areas of Groups 1 through 3, 5, and 7 through 9 exposed to outdoor air and that the GALL Report recommends further evaluation to determine whether a plant-specific AMP is needed for plants located in moderate to severe weathering conditions. The SRP-LR also states that a plant-specific AMP is not required if documented evidence confirms that the existing concrete had air entrainment content between 3 and 8 percent and if subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the LSCS concrete requiring freeze-thaw resistance had air entrainment of 3 to 5 percent, which meets the GALL Report recommended air content requirement of between 3 and 8 percent, and the plant operating experience has not exhibited signs of aging effects related to freeze-thaw in accessible areas of Groups 1 through 3 concrete structures. The applicant further stated that the Structures Monitoring program will be used to manage this aging effect in both accessible and inaccessible areas by performing inspections of accessible areas and by using the condition of accessible and above-grade concrete as an indicator for the condition of inaccessible and below-grade concrete. The applicant further stated that, if degradation of concrete due to freeze-thaw is identified in accessible areas of the structures, the extent of condition will be determined and additional inspections or evaluations will be initiated to evaluate acceptability of inaccessible portions of structures. In addition, exposed portions of below-grade concrete will be examined by the enhanced Structures Monitoring program when it is excavated for any reason.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.19. The staff reviewed UFSAR Section 3.8.4.6 and Appendix E, Section E.1, which indicate that concrete was specified in accordance with ACI 318-71 and ACI 301-72, and verified that appropriate air entrainment was used in the concrete mix design. The staff's review of the operating experience did not identify any significant freeze-thaw-related concrete degradation for Groups 1 through 3 structures at LSCS; therefore, a plant-specific program to manage this aging effect is not necessary. Further, the staff noted that the applicant will use the enhanced Structures Monitoring program to monitor aging effects due to freeze-thaw for Groups 1 through 3 structures, which is the GALL Report-recommended program to manage this aging effect in accessible areas as indicated by SRP-LR Table 3.5-1, item 64, and LRA Table 3.5.1, item 3.5.1-64. In its review of components associated with LRA item 3.5.1-42, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the enhanced Structures Monitoring program is acceptable because (1) the program is capable of monitoring and managing aging effects due to freeze-thaw by performing periodic visual inspections of accessible areas of Groups 1 through 3 structures by qualified personnel at intervals not to exceed 5 years, (2) the program will use significant freeze-thaw degradation identified in accessible areas as the leading indicator to evaluate the acceptability of the aging effect in inaccessible areas of affected structures in the corrective action program, and (3) a plant-specific program is not necessary.

Based on the evaluation provided and on the program identified, the staff determines that the applicant's program meets the SRP-LR Section 3.5.2.2.2.1, item 1, criteria. For those items associated with LRA Section 3.5.2.2.2.1.1, the staff concludes 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).

Item 2. LRA Section 3.5.2.2.2.1.2, associated with LRA Table 3.5.1, item 3.5.1-43, addresses cracking due to expansion from reaction with aggregates in inaccessible concrete areas exposed to any environment for structures of all groups, except for Group 6 structures. The criteria in SRP-LR Section 3.5.2.2.2.1, item 2, state that further evaluation is recommended to determine whether a plant-specific AMP is required to manage this aging effect. The SRP-LR also states that a plant-specific program is not required if (1) investigations, tests, and petrographic examination of aggregates performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within reinforced concrete or (2) for potentially reactive aggregates, aggregate concrete reaction is not significant if it can be demonstrated that the in-place concrete can perform its intended function. The applicant addressed the further evaluation criteria by stating that a plant-specific program is not necessary to manage the aging effect and mechanism because the fine and coarse aggregates used in the concrete conform to ASTM C33, aggregates were screened for reactivity by tests performed in accordance with ASTM C227, and the aging effect/mechanism has not been observed on accessible portions of LSCS concrete structures. The applicant further stated that, nevertheless, the aging effect and mechanism is applicable to LSCS concrete structures because industry operating experience described in NRC IN 2011-20 indicates that the older ASTM standards used during construction may not always be effective in identifying reactive aggregates and that these structures will be monitored by the Structures Monitoring program for cracking due to any mechanism, which includes expansion from reaction with aggregates, and by using conditions observed in accessible areas as the indicator of conditions at inaccessible areas. Additionally, the applicant stated that the program will also examine exposed portions of below-grade concrete when it is excavated for any reason.

The staff's evaluation of the applicant's Structures Monitoring program, which, with enhancements, will be consistent with GALL Report AMP XI.S6, is documented in SER Section 3.0.3.2.19. The staff noted that this enhanced AMP, as amended by the applicant's response to RAI B.2.1.34-1, dated July 15, 2015, requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or could result in, degradation to such inaccessible areas. The staff noted that a plant-specific AMP is not necessary because the LSCS concrete structures were constructed to recommended ACI and ASTM standards that minimize the possibility of cracking due to alkali-aggregate reaction and because a review of the operating experience did not identify the aging effect/mechanism in accessible portions of LSCS concrete structures. The staff noted that the applicant proposed to use the Structures Monitoring program to effectively manage the aging effect, which is consistent with the GALL Report recommendation for this aging effect in accessible areas, as indicated in SRP-LR Table 3.5-1, item 54, and LRA Table 3.5.1, item 3.5.1-54. GALL Report AMP XI.S6 recommends using periodic visual inspections by qualified personnel, at an interval not to exceed 5 years, to manage the effects of aging. The staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) the program will manage cracking from expansion due to reaction with aggregates by performing periodic visual inspections of accessible areas of structures of all groups at intervals not to exceed 5 years, (2) the program will use conditions identified in accessible areas as the leading indicator to evaluate the acceptability of the aging effect in inaccessible areas of affected structures in the corrective action program, and (3) a plant-specific program is unnecessary.

Based on the evaluation provided and program identified, the staff determines that the applicant's programs meet the SRP-LR Section 3.5.2.2.2.1, item 2, criteria. For those items associated with LRA Section 3.5.2.2.2.1.2, the staff concludes 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).

Item 3. LRA Section 3.5.2.2.2.1.3, associated with LRA Table 3.5.1, item 3.5.1-44, addresses below-grade inaccessible concrete areas of structures of all groups of concrete founded on, and exposed to, groundwater and soil, which will be managed for cracking and distortion due to increased stress levels from settlement by the Structures Monitoring program. In addition, LRA Section 3.5.2.2.2.1.3, associated with LRA Table 3.5.1, items 3.5.1-45 and 3.5.1-46, addresses below-grade inaccessible concrete areas of Groups 1 through 3 and 5 through 9 structures exposed to water flowing under foundation, which will be managed for reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation. The criteria in SRP-LR Section 3.5.2.2.2.1, item 3, state that cracking and distortion due to increased stress levels from settlement could occur in below-grade inaccessible concrete areas of structures of all groups (exposed to soil), and reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1 through 3 and 5 through 9 structures (exposed to water flowing under foundation). The SRP-LR states that the existing program relies on the Structures Monitoring program to manage these aging effects and that further evaluation is necessary if a dewatering system is relied on to control settlement to verify continued functioning of the dewatering system through the period of extended operation. The applicant addressed the further evaluation criteria of the SRP-LR for LRA item 3.5.1-44 by stating that LSCS structures do not rely on a dewatering system to control settlement and that, even though the aging effect has not been observed at LSCS, the Structures Monitoring program will be used to manage cracking and distortion due to any mechanism, including settlement, for structures founded on soil by evaluating the aging effects in inaccessible areas based on conditions found from inspection of accessible areas as the leading indicator. The applicant also stated that LSCS will examine exposed portions of below-grade concrete when it is excavated for any reason. The applicant also addressed the further evaluation criteria of the SRP-LR for LRA items 3.5.1-45 and 3.5.1-46 by stating that the aging effect is not applicable because LSCS structures are not founded on porous concrete subfoundations and do not rely on a dewatering system to control settlement.

The staff's evaluation of the applicant's Structures Monitoring program, which with enhancements will be consistent with GALL Report AMP XI.S6, is documented in SER Section 3.0.3.2.19. The staff reviewed UFSAR Sections 2.4.13, 2.5.4, and 3.8.5 and verified that dewatering systems are not relied on to control settlement; therefore, LRA Table 3.5.1, items 3.5.1-44 through 3.5.1-46, do not need further evaluation. The staff also noted that the LSCS structures are not founded on porous concrete subfoundations but are generally founded on silty clay. The staff evaluated the applicant's claim that the aging effect for LRA Table 3.5.1, items 3.5.1-45 and 3.5.1-46, is not applicable and finds it acceptable because the staff verified that the LSCS concrete structures are not founded on porous concrete subfoundation and do not rely on a dewatering system to control settlement. The staff also noted that the applicant's proposal to continue use of the enhanced Structures Monitoring program to manage cracking and distortion due to increased stress levels from settlement, based on evaluating the aging effects in inaccessible concrete areas using conditions observed from visual inspections of accessible areas, is consistent with the GALL Report recommendation and, therefore, is acceptable. In its review of components associated with LRA item 3.5.1-44, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because the staff verified that the LSCS structures do not rely on a dewatering system to control settlement and because the enhanced Structures Monitoring program proposed to manage the aging effect of cracking and distortion due to settlement is consistent with the GALL Report.

Based on the program identified, the staff determines that the applicant's program meets the SRP-LR Section 3.5.2.2.2.1, item 3, criteria. For those items associated with LRA Section 3.5.2.2.2.1.3, the staff concludes 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).

Item 4. LRA Section 3.5.2.2.2.1.4 associated with LRA Table 3.5.1, item 3.5.1-47, addresses inaccessible concrete areas of Groups 1 through 3 and 5 structures (Groups 7 through 9 structures not applicable to LSCS) that are exposed to flowing water, which will be managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation by the Structures Monitoring program. The criteria in SRP-LR Section 3.5.2.2.2.1, item 4, state that increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible areas of Group 1 through 5 and 7 through 9 concrete structures exposed to a water-flowing environment. The SRP-LR also states that further evaluation is required to determine whether a plant-specific AMP is needed to manage increases in porosity and permeability due to leaching of calcium hydroxide and carbonation of inaccessible concrete areas and that a plant-specific AMP is not required if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation or (2) an evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. The applicant addressed the further evaluation criteria of the SRP-LR by stating that LSCS concrete structures are designed and constructed in accordance with ACI standards to produce durable concrete that is resistant to leaching. The applicant also stated that the effects of carbonation have not been observed on LSCS concrete, although some leaching has been observed in the accessible areas; that they are not significant; and that they have not impacted the intended functions. The applicant concluded that increases in porosity and permeability and loss of strength due to leaching and carbonation are adequately managed by the Structures Monitoring program by visual inspection of accessible areas and exposed portions of inaccessible areas when these areas are excavated for any reason, by periodic groundwater testing, and by evaluation of aging effects in inaccessible areas based on conditions found in accessible areas.

The staff's evaluation of the applicant's Structures Monitoring program, which, with enhancements, will be consistent with GALL Report AMP XI.S6, is documented in SER Section 3.0.3.2.19. The staff noted that the applicant's proposal to continue use of the enhanced Structures Monitoring program to manage the aging effect, based on evaluating the aging effects in inaccessible concrete areas using conditions observed from visual inspections of accessible areas, is consistent with the GALL Report recommendation for accessible areas (LRA Table 3.5.1, item 3.5.1-63) and, therefore, is acceptable. In its review of components associated with item 3.5.1-47, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because this program is the GALL Report-recommended program for managing the aging effects by visual inspection of accessible areas and by evaluation of inaccessible concrete areas based on conditions found in accessible areas, and because LSCS does not have operating experience of significant leaching or carbonation that would affect the intended function of the structure, an additional plant-specific program is not necessary.

Based on the evaluation provided and the program identified, the staff determines that the applicant's program meets the SRP-LR Section 3.5.2.2.2.1, item 4, criteria. For those items associated with LRA Section 3.5.2.2.2.1.4, the staff concludes 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).

<u>Reduction of Strength and Modulus Due to Elevated Temperature</u>. LRA Section 3.5.2.2.2.2, associated with LRA Table 3.5.1, item 3.5.1-48, addresses reduction of strength and modulus of concrete due to elevated temperatures in Groups 1 through 5 concrete structures exposed to an air-indoor uncontrolled environment. The criteria in SRP-LR Section 3.5.2.2.2.2 state that the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits (i.e., general area temperature greater than 150 °F and local area temperature greater than 200 °F). The GALL Report states that higher temperatures may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and if these reductions are applied to the design calculations. The applicant stated that this item is not applicable because the average temperature for these groups of structures does not exceed 135 ºF and because local temperatures in excess of 200 ºF have not been reported at LSCS. The applicant also stated that process piping that operates at temperatures greater than 200 ºF is insulated through penetrations and is combined with compartment air circulation to reduce concrete local temperature to less than 200 ºF. The staff evaluated the applicant's claim and finds it acceptable because the staff reviewed UFSAR Subsections 6.2.1.1.2, 3.8.1.1.3.5, and 9.4 and confirmed that (1) a primary containment ventilation system maintains the general area temperatures for Group 4 structures below the threshold from the GALL Report during normal operation, (2) other groups of structures maintain their general area temperatures below the threshold from the GALL Report using other normal ventilation systems, and (3) the design of the penetration sleeves provides insulation, air gaps, and cooling coil systems to reduce thermal stress in the concrete during normal operations. Additionally, the staff's review of site operating experiences during the AMP audit did not identify plant conditions where general or local areas temperatures have exceeded the threshold from the GALL Report. Therefore, a plant-specific AMP is not required, and further evaluation of this aging effect is not necessary.

<u>Aging Management of Inaccessible Areas for Group 6 Structures</u>

<u>*Item 1*</u>. LRA Section 3.5.2.2.2.3.1 associated with LRA Table 3.5.1, item 3.5.1-49, addresses inaccessible concrete areas of Group 6 structures exposed to an air-outdoor environment for plants located in moderate to severe weathering conditions, which will be managed for loss of material and cracking due to freeze-thaw by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The criteria in SRP-LR

Section 3.5.2.2.2.3, item 1, state that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur for below-grade inaccessible concrete areas of Group 6 structures and recommends further evaluation to determine the need for a plant-specific program for plants located in moderate to severe weathering conditions. The SRP-LR also states that a plant-specific program is not required if documented evidence confirms that the existing concrete had air entrainment content between 3 and 8 percent and if subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the LSCS concrete requiring freeze-thaw resistance meets the air content requirement of between 3 and 8 percent and that plant operating experience has not identified significant aging effects related to freeze-thaw in accessible areas of Groups 6 concrete structures. The applicant also stated that the existing RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, with enhancements, will be used to manage this aging effect in an air-outdoor environment. The applicant further stated that the condition of accessible and above-grade concrete will be used as the leading indicator for the condition of inaccessible areas and that, if degradation of concrete due to freeze-thaw is identified in accessible areas of the structures, corrective action will be initiated to evaluate acceptability of the aging effect in inaccessible portions of affected structures in the corrective action program. The applicant also stated that exposed portions of the below-grade concrete will be examined when excavated for any reason.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, which, with enhancements, will be consistent with GALL Report AMP XI.S7, is documented in SER Section 3.0.3.2.20. The staff reviewed UFSAR Section 3.8.4.6 and Appendix E, Section E.1, which indicate that concrete was specified in accordance with ACI 318-71 and ACI 301-72, and verified that appropriate air entrainment was used in the concrete mix design. The staff's review of the applicant's operating experience did not identify significant freeze-thaw related concrete degradation; therefore, a plant-specific program to manage this aging effect is not necessary. The staff noted that the applicant's enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will be used to manage this aging effect for Group 6 concrete structures. In its review of components associated with LRA item 3.5.1-49, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is acceptable because (1) the enhanced program will monitor and manage aging effects due to freeze-thaw of Group 6 structures by periodic visual inspections of accessible areas, (2) the program will use significant freeze-thaw degradation identified in accessible areas as the leading indicator to evaluate the acceptability of the aging effect in inaccessible areas, and (3) a plant-specific program is not necessary.

Based on the program identified, the staff determines that the applicant's program meets the SRP-LR Section 3.5.2.2.3.1, item 1, criteria. For those items associated with LRA Section 3.5.2.2.2.3.1, the staff concludes 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).

Item 2. LRA Section 3.5.2.2.2.3.2, associated with LRA Table 3.5.1, item 3.5.1-50, addresses cracking due to expansion from reaction with aggregates in below-grade inaccessible concrete areas of Group 6 structures exposed to any environment. The criteria in SRP-LR Section 3.5.2.2.2.3.2 state that further evaluation is recommended to determine whether a plant-specific AMP is required to manage this aging effect. The SRP-LR also states that a plant-specific program is not required if (1) investigations, tests, and petrographic examination of aggregates performed in accordance with ASTM C295 and other ASTM reactivity tests, as required, can demonstrate that those aggregates do not adversely react within concrete or (2) for potentially reactive aggregates, aggregate concrete reaction is not significant if it is demonstrated that the in-place concrete can perform its intended function. The applicant addressed the further evaluation criteria by stating that a plant-specific program is not necessary to manage the aging effect and mechanism because the fine and coarse aggregates used in the concrete conform to ASTM C33, aggregates were screened for reactivity by tests performed in accordance with ASTM C227, and the aging effect/mechanism has not been observed on accessible portions of LSCS Group 6 concrete structures. The applicant further stated that, nevertheless, the aging effect and mechanism is applicable to LSCS concrete structures because industry operating experience described in NRC IN 2011-20 indicates that the older ASTM standards used during construction may not always be effective in identifying reactive aggregates and that these structures will be monitored within the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program (implemented as part of Structures Monitoring program) by monitoring cracking due to any mechanism, which includes expansion from reaction with aggregates, and by using conditions observed in accessible areas as the indicator of conditions at inaccessible areas. Additionally, the applicant stated that the program will also examine exposed portions of below-grade concrete when excavated for any reason.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Plants program and Structures Monitoring program, which, with enhancements, will be consistent with GALL Report AMP XI.S7 and AMP XI.S6, respectively, is documented in SER Sections 3.0.3.2.20 and 3.0.3.2.19, respectively. The staff noted that the enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Plants program and the Structures Monitoring program require evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or could result in, degradation to such inaccessible areas. The staff noted that a plant-specific AMP is not necessary because the LSCS concrete structures were constructed to recommended ACI and ASTM standards that minimize the possibility of cracking due to alkali-aggregate reaction and because review of the operating experience did not identify the aging effect/mechanism in accessible portions of LSCS Group 6 concrete structures. The staff noted that the applicant proposed to use the Structures Monitoring program to manage the aging effect in accessible areas for all structures groups, including Group 6 as indicated in LRA Table 3.5.1, item 3.5.1-54, which is considered consistent with the GALL Report recommendation for this aging effect in accessible areas because the GALL Report, inadvertently, did not identify an AMP for accessible areas of Group 6 structures. GALL Report AMP XI.S6 and AMP XI.S7 recommend using periodic visual inspections by qualified personnel, at an interval not to exceed 5 years, to manage the effects of aging. The staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging in inaccessible areas using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Plants program and Structures Monitoring program is acceptable because (1) the program will manage cracking from expansion due to reaction with aggregates by performing periodic visual inspections of accessible areas of Group 6 structures at intervals not to exceed 5 years, (2) the program will use conditions identified in accessible areas as the leading indicator to evaluate the acceptability of the aging effect in inaccessible areas of affected structures in the corrective action program, and (3) a plant-specific program is not necessary.

Based on the evaluation provided and on the program identified, the staff determines that the applicant's programs meet the SRP-LR Section 3.5.2.2.2.3, item 2, criteria. For those items associated with LRA Section 3.5.2.2.2.3.2, the staff concludes 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).

Item 3. LRA Section 3.5.2.2.2.3.3, associated with LRA Table 3.5.1, item 3.5.1-51, addresses inaccessible concrete areas of Groups 6 structures exposed to a water-flowing environment, which will be managed for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The criteria in SRP-LR Section 3.5.2.2.2.3, item 3, state that increases in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation could occur in below-grade inaccessible concrete areas of Group 6 concrete structures. The SRP-LR also states that further evaluation is required if leaching is observed in accessible areas that impact intended functions. The SRP-LR also states that further evaluation is required to determine whether a plant-specific AMP is needed to manage the aging effect and that a plant-specific program is not required for the concrete exposed to water-flowing environment if (1) there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation or (2) an evaluation determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. The applicant addressed the further evaluation criteria of the SRP-LR by stating that LSCS concrete structures are designed and constructed in accordance with ACI standards to produce durable concrete that is resistant to leaching. The applicant stated that the effects of carbonation have not been observed on LSCS concrete. The applicant also stated that the groundwater and cooling lake water chemistry at the site is not aggressive and that, although some leaching has been observed in the accessible areas, it is not significant and has not impacted intended functions. The applicant concluded that the operating experience indicates that the observed leaching has had no significant impact on the intended function of the concrete structure and that the effects of leaching and carbonation are adequately managed by the enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program by (1) visual inspection of accessible and submerged concrete areas and exposed portions of inaccessible areas when these areas are excavated for any reason, (2) periodic testing of groundwater and raw water chemistry, and (3) evaluation of aging effects in inaccessible areas based on conditions found in accessible areas.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Plants program is documented in SER Section 3.0.3.2.20. This program, with enhancements, will be consistent with GALL Report AMP XI.S7. The staff noted that the operating experience at LSCS did not identify significant aging effects of degradation due to leaching and carbonation; therefore, a plant-specific AMP is not necessary to manage this aging effect. Further, the staff noted that the enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program, implemented as part of the Structures Monitoring program, will be used to manage this aging effect for Group 6 concrete structures. In its review of components associated with item 3.5.1-51, the staff finds that the applicant has met the further evaluation criteria and that the applicant's proposal to manage the effects of aging using the enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is acceptable because this program is capable of effectively monitoring and managing these aging effects by (1) performing visual inspection of accessible areas every 5 years, and exposed portions of inaccessible areas on an opportunistic basis, and (2) evaluating inaccessible concrete areas based on conditions found in accessible areas as the leading indicator. In addition, because LSCS does not have operating experience of significant leaching or carbonation that would affect the intended function of the structure, an additional plant-specific program is not necessary.

Based on the programs identified, the staff determines that the applicant's programs meet the SRP-LR Section 3.5.2.2.3.3, item 3, criteria. For those items associated with LRA Section 3.5.2.2.2.3.3, the staff concludes 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).

Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion. LRA Section 3.5.2.2.2.4, associated with LRA Table 3.5.1, item 3.5.1-52, addresses cracking due to SCC and loss of material due to pitting and crevice corrosion in stainless steel liners of other components, such as the drywell sump, reactor building sump, and turbine building sump, exposed to a fluid environment. The criteria in SRP-LR Section 3.5.2.2.2.4 state that cracking due to SCC and loss of material due to pitting and crevice corrosion could occur for Group 7 and Group 8 stainless steel tank liners exposed to standing water. The SRP-LR also states that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects for stainless steel tank liners exposed to standing water. The applicant stated that this item is not applicable because LSCS does not have Group 7 and Group 8 stainless steel tank liners exposed to standing water. The GALL Report recommends a plant-specific program be evaluated to ensure that these aging effects are adequately managed; however, the staff notes that the applicant does not have any tanks with stainless steel liners included as structures within the scope of license renewal. Therefore, no plant-specific program is needed.

Cumulative Fatigue Damage Due to Fatigue. LRA Section 3.5.2.2.2.5, associated with LRA Table 3.5.1, item 3.5.1-53, addresses fatigue in component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports. The criteria in SRP-LR Section 3.5.2.2.2.5 state that fatigue of these components is a TLAA only if a CLB fatigue analysis exists. The applicant stated that this item is not applicable because the CLB at LSCS does not contain fatigue analyses for support members, bolted connections, or supported anchorage to building structures. The staff evaluated the applicant's claim and finds it acceptable because the staff reviewed the UFSAR and did not identify any fatigue analyses for these components.

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 QA program.

3.5.2.2.4 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL

In LRA Tables 3.5.2-1 through 3.5.2-14, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations that are not consistent with or are not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-14, the applicant indicated, through notes F through J, that the combination of the component type, material, environment, and AERM does not correspond to an item in the GALL Report. The applicant provided further information on 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 that are 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 Auxiliary Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the Auxiliary Building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Auxiliary Building component groups are consistent with the GALL Report.

3.5.2.3.2 Component Supports Commodity Group – Summary of Aging Management Evaluation – LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the Component Supports Commodity Group component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Component Supports Commodity Group component groups are consistent with the GALL Report.

3.5.2.3.3 Cooling Lake – Summary of Aging Management Evaluation – LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the Cooling Lake component groups.

<u>Soil, Rip-Rap, Sand, and Gravel of Earthen Water-Control Structures Exposed to an Air-Outdoor Environment</u>. In LRA Table 3.5.2-3, the applicant stated that soil, rip-rap, sand, and gravel of earthen water-control structures (i.e., the intake flume and submerged core standby cooling system pond) exposed to an air-outdoor environment will be managed for loss of material and loss of form by the RG 1.127, Inspection of Water-Control Structures Associated

with Nuclear Power Plants program. The AMR items cite generic note G. The AMR items also cite plant-specific note 1, which states that the aging effect for this component, material, and environment combination is not in the GALL Report; however, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will be used to manage this component's aging effect.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff reviewed a U.S. Society on Dams report titled, "The Aging of Embankment Dams," dated 2010, which states that "erosion on the downstream slope and crest may be due to heavy direct rainfall or surface water runoff, brief crest overtopping, wave spray over a wave wall or wind driven wave spray," and that "[surface] erosion on the upstream slope may be due to wave action on too small riprap or inadequate bedding, breakdown of riprap or freeze-thaw displacement." Based on its review of this report, which further states that "surface erosion is readily detected by routine visual inspection," the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is documented in SER Section 3.0.3.2.20. The staff notes that managing for loss of material and loss of form is equivalent to managing surface erosion and that these aging effects are readily detectible by visual inspections. The staff finds the applicant's proposal to manage the effects of aging using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program provides for periodic visual inspections at least once every 5 years and immediately following the occurrence of significant natural phenomena, which is consistent with the visual inspection frequency recommended in GALL Report AMP XI.S7 and determined to be adequate to detect aging effects in earthen water-control structures before the loss of component's intended function.

3.5.2.3.4 Diesel Generator Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the Diesel Generator Building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Diesel Generator Building component groups are consistent with the GALL Report.

3.5.2.3.5 Lake Screen House – Summary of Aging Management Evaluation – LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the Lake Screen House component groups.

Reinforced Concrete of Lake Screen House Interior Exposed to a Water-Flowing Environment. In LRA Table 3.5.2-5, the applicant stated that reinforced concrete in the Lake Screen House interior exposed to a water-flowing environment will be managed for cracking, loss of bond, and loss of material (spalling, scaling) by the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program. The AMR items cite generic note H. The AMR items also cite plant-specific note 2, which states that the aging effect for this component, material, and environment combination is not in the GALL Report; however, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will be used to manage this component's aging effect.

The staff noted that this material and environment combination is identified in the GALL Report, which states that concrete exposed to a water-flowing environment is susceptible to increases in porosity and permeability, loss of strength due to leaching of calcium hydroxide and carbonation, and loss of material due to abrasion or cavitation and recommends GALL Report AMP XI.S7 to manage the aging effects. However, the applicant has identified cracking and loss of bond as additional aging effects. The applicant addressed the GALL Report identified aging effects for this component, material, and environment combination in other AMR items in LRA Table 3.5.2-5 (i.e., items corresponding to Table 1, items 3.5.1-56 and 3.5.1-61).

The staff's evaluation of the applicant's RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant implements the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program as part of the Structures Monitoring program to manage these aging effects for water-control structures by performing periodic visual inspection at least once every 5 years. The staff finds the applicant's proposal to manage cracking, loss of bond, and loss of material (spalling, scaling) using the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program acceptable because the program provides for periodic visual inspections at least once every 5 years and immediately following the occurrence of significant natural phenomena to manage the aging effects (i.e., increases in porosity and permeability, loss of strength, and loss of material) in the GALL Report and additional plant-specific aging effects (i.e., cracking and loss of bond) for concrete in water-control structures exposed to a water-flowing environment, which is consistent with the visual inspection frequency recommended in the GALL Report AMP determined to be adequate to detect aging effects before there is a loss of a component's intended function.

3.5.2.3.6 Offgas Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the Offgas Building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Offgas Building component groups are consistent with the GALL Report.

3.5.2.3.7 Primary Containment – Summary of Aging Management Evaluation – LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the Primary Containment component groups.

<u>Carbon Steel Sliding Surfaces (Support) Exposed to an Air-Indoor Uncontrolled Environment</u>. In LRA Table 3.5.2-7, the applicant stated that the carbon steel sliding surfaces support exposed to an air-indoor uncontrolled environment will be managed for loss of mechanical function by the Structures Monitoring program. The AMR item cites generic note F. The AMR item also cites plant-specific note 9, which states that the sliding supports and bearings for drywell steel beams do not use Lubrite or a similar material but are instead steel to steel connections.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed the loss of material aging effect for this component, material, and environment combination in other AMR items in LRA Table 3.5.2-7. Based on its review of GALL Report Section IX.E, which states that loss of mechanical function in components, such as sliding steel surfaces, can occur through the combined influence of a number of aging mechanisms that include corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads, or elastomer hardening, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.19. The staff noted that the Structures Monitoring program proposes to manage the effects of aging loss of material due to wear or corrosion, debris, or dirt for sliding surfaces through the use of periodic visual inspections (Commitment No. 34). The staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the AMP will monitor sliding surfaces for excessive loss of material due to wear or corrosion, debris, or dirt and, therefore, will manage loss of mechanical function to ensure that no debris or dirt could restrict or prevent sliding of the surfaces as required by design, consistent with the GALL Report recommendations.

<u>Concrete (Interior) in Primary Containment Components Encased in Steel</u>. In LRA Table 3.5.2-7, the applicant stated that, for concrete (interior) in primary containment components, including the pedestal, suppression pool columns, and reactor shield wall, that are encased in steel, there is no aging effect and that no AMP is proposed. The AMR items cite generic note G. The AMR items also cite plant-specific note 1, which states that the environment "encased in steel" protects concrete from other environments that promote age-related degradation.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environmental combination. The staff finds the applicant's proposal acceptable because (1) the concrete component is protected by the steel encasement from the environments that could cause age-related degradation to occur in the concrete and, therefore, exhibits no AERMs and (2) periodic visual inspections to detect loss of material of the steel components that encase the pedestal, suppression pool columns, and reactor shield wall are performed by the Structures Monitoring program and the ASME Section XI, Subsection IWE program per the LRA Table 3.5.2-7 items corresponding to Table 1, items 3.5.1-37 and 3.5.1-77.

<u>Fiberglass Components of Permanent Drywell Shielding Exposed to an Air-Indoor Uncontrolled Environment</u>. In LRA Table 3.5.2-7, the applicant stated that the fiberglass components of permanent drywell shielding exposed to an air-indoor uncontrolled environment will be managed for changes in material properties (defined by the applicant as rips and tears by plant-specific note 3, as described below) by the Structures Monitoring program. The AMR item cites generic note J. The AMR item also cites plant-specific note 3, which states that lead shielding in an air-indoor uncontrolled environment has no applicable AERMs; however, the fiberglass blanket covers will be inspected by the Structures Monitoring program for rips and tears.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment (air-indoor environment subject to radiation and thermal exposure) description. The staff notes that the fiberglass covers used in the nuclear industry for lead shielding blankets are made of silicon-impregnated fiberglass fabric designed for the high-temperature environment in the drywell. Visual inspections are used to ensure that the function of the lead shielding blankets are maintained by identifying breaches in the fiberglass covers. The staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.19. The staff noted that the Structures Monitoring program proposes to manage the effects of aging through the use of periodic visual inspections at intervals not to exceed 5 years. The staff also noted that enhancement 10 (Commitment No. 34, item 10), as amended by the applicant's response letter dated July 15, 2015, to RAI B.2.1.34-2, states that the Structures Monitoring program will be enhanced to inspect the fiberglass outer covering for the permanent drywell shielding for signs of rips and tears; if a rip or tear is found, the permanent drywell shielding will be repaired or replaced. The staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the program's visual inspections are capable of detecting rips and tears and, therefore, will adequately identify and manage degradation in fiberglass covers of the permanent drywell shielding before the loss of its intended function.

Lead Shielding Exposed to Uncontrolled Indoor Air. In LRA Tables 3.5.2-7, 3.5.2-9, and 3.5.2-10, the applicant stated that, for lead shielding exposed to an uncontrolled indoor air environment, there is no aging effect and that no AMP is proposed. The AMR items cite generic note J.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environmental combination. The staff finds the applicant's proposal acceptable based on its review of the *Handbook of Corrosion Data*, dated 1989, which states that "lead is highly resistant [to corrosion] in atmospheric exposures … lead exhibits consistent durability in all types of atmospheres, including rural, industrial and marine."

Service Level I Coating (Containment Boundary and Internal Structures) Exposed to Treated Water. In LRA Table 3.5.2-7, the applicant stated that Service Level I coating exposed to treated water will be managed for loss of coating integrity by the Protective Coating Monitoring and Maintenance Program. The AMR items cite generic note G. The AMR items cite plant-specific note 6, which states that the Protective Coating Monitoring and Maintenance Program is the applicable AMP for this component, material, environment, and aging effect combination.

The staff reviewed the associated items in the LRA and considered whether the aging effects proposed by the applicant constitute all of the credible aging effects for this component, material, and environment description. The staff noted that the applicant addressed loss of coating integrity for this component, material, and environment combination in other AMR items in LRA Table 3.5.2-7. Based on its review of GALL Report AMP XI.S8, which states that all readily accessible Service Level I coatings should be periodically inspected to prevent loss of material, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The staff's evaluation of the applicant's Protective Coating Monitoring and Maintenance Program is documented in SER Section 3.0.3.1.16. The staff finds the applicant's proposal to manage the effects of aging using the Protective Coating Monitoring and Maintenance Program acceptable because the program includes coating system selection, application, inspection, assessment, maintenance, and repair for any condition that adversely affects the ability of Service Level I coatings to function as intended.

3.5.2.3.8 Radwaste Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the Radwaste Building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Radwaste Building component groups are consistent with the GALL Report.

3.5.2.3.9 Reactor Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the Reactor Building component groups.

<u>Lead Shielding Exposed to Uncontrolled Indoor Air</u>. The staff's evaluation for lead shielding exposed to an uncontrolled indoor air environment, with no aging effect and associated with generic note J, is documented in SER Section 3.5.2.3.7.

3.5.2.3.10 Structural Commodity Group – Summary of Aging Management Evaluation – LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the Structural Commodity Group.

<u>Elastomers Exposed to Condensation</u>. In LRA Table 3.5.2-10, the applicant stated that foamed plastic and polymer thermal insulation exposed to uncontrolled indoor air is subject to reduced thermal insulation resistance. The AMR items cite generic note F, and plant-specific note 1, which states that foamed plastic, polymer, and other insulation and insulation sealant materials are potentially subject to reduced thermal insulation resistance due to moisture intrusion. Plant-specific note 1 further states that the potential aging effect will be managed by the External Surfaces Monitoring of Mechanical Components program.

The staff's evaluation of the applicant's External Surfaces Monitoring of Mechanical Components program is documented in SER Section 3.0.3.1.12. The staff finds the applicant's proposal to monitor any potential aging effect using the External Surfaces Monitoring of Mechanical Components program acceptable because the periodic visual inspections conducted by the program are capable of detecting moisture intrusion on the subject components.

<u>Lead Shielding Exposed to Uncontrolled Indoor Air</u>. The staff's evaluation for lead shielding exposed to an uncontrolled indoor air environment, with no aging effect and associated with generic note J, is documented in SER Section 3.5.2.3.7.

3.5.2.3.11 Switchyard Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the Switchyard Structures component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Switchyard Structures component groups are consistent with the GALL Report.

3.5.2.3.12 Tank Foundations and Dikes – Summary of Aging Management Evaluation – LRA Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the Tank Foundations and Dikes component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Tank Foundations and Dikes component groups are consistent with the GALL Report.

3.5.2.3.13 Turbine Building – Summary of Aging Management Evaluation – LRA Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the Turbine Building component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Turbine Building component groups are consistent with the GALL Report.

3.5.2.3.14 Yard Structures – Summary of Aging Management Evaluation – LRA Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the Yard Structures component groups. The staff's review did not identify any AMR items with notes F through J, indicating that the combinations of component type, material, environment, and AERM for the Yard Structures component groups are consistent with the GALL Report.

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 and commodity groups 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 <u>Aging Management of Electrical Components</u>

This section of the SER documents the staff's review of the applicant's AMR results for the following Electrical commodity groups:

- Cable Connections (Metallic Parts)
- Electric Penetrations
- High Voltage Insulators
- Insulation Material for Electrical Cables and Connections
- Metal Enclosed Bus
- Switchyard Bus and Connections, Transmission Conductors, and Transmission Connectors

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical components commodity groups. LRA Table 3.6.1, "Summary of Aging Management Evaluations for the Electrical Components," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for electrical components.

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 electrical 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 the applicant's AMRs to verify the applicant's claim that certain AMRs are consistent with the GALL Report or are not applicable. 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 is applicable and that the applicant identified the appropriate GALL Report AMRs. AMRs that the staff confirmed are consistent with the GALL Report are noted as such in Table 3.6-1; therefore, no further discussion is required. AMRs that the staff confirmed are not applicable to LSCS or require no aging management are noted in Table 3.6-1 and are discussed in SER Section 3.6.2.1.1.

During its review, the staff also reviewed AMRs consistent with the GALL Report and those 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 evaluations of AMRs for which the GALL Report recommends further evaluation are documented in SER Section 3.6.2.2.

The staff also conducted a technical review of the remaining AMRs that are not consistent with or are 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 of AMRs that are not consistent with or are not addressed in the GALL Report are documented in SER Section 3.6.2.3.

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 Components in the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials exposed to adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage (3.6.1-1)	Various aging effects due to various mechanisms in accordance with 10 CFR 50.49	EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii). See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii).	Yes	TLAA	Consistent with the GALL Report (see SER Section 3.6.2.2.1)
High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor (3.6.1-2)	Loss of material due to mechanical wear caused by wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.2)
High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor (3.6.1-3)	Reduced insulation resistance due to presence of salt deposits or surface contamination	A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution)	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.2)
Transmission conductors composed of aluminum; steel exposed to air – outdoor (3.6.1-4)	Loss of conductor strength due to corrosion	A plant-specific aging management program is to be evaluated for ACSR	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.3)
Transmission connectors composed of aluminum; steel exposed to air – outdoor (3.6.1-5)	Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.3)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Switchyard bus and connections composed of aluminum; copper; bronze; stainless steel; galvanized steel exposed to air – outdoor (3.6.1-6)	Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation or loss of pre-load	A plant-specific aging management program is to be evaluated	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.3)
Transmission conductors composed of aluminum; steel exposed to air – outdoor (3.6.1-7)	Loss of material due to wind-induced abrasion	A plant-specific aging management program is to be evaluated for ACAR and ACSR	Yes	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.2.3)
Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture (3.6.1-8)	Reduced insulation resistance due to thermal/ thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Chapter XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Consistent with the GALL Report
Insulation material for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture (3.6.1-9)	Reduced insulation resistance due to thermal/thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Chapter XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits"	No	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by significant moisture (3.6.1-10)	Reduced insulation resistance due to moisture	Chapter XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"	No	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Consistent with the GALL Report
Metal enclosed bus: enclosure assemblies composed of elastomers exposed to air – indoor, controlled or uncontrolled or air – outdoor (3.6.1-11)	Surface cracking, crazing, scuffing, dimensional change (e.g., "ballooning" and "necking"), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation	Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	No	Metal Enclosed Bus	Consistent with the GALL Report
Metal enclosed bus: bus/connections composed of various metals used for electrical bus and connections exposed to air – indoor, controlled or uncontrolled or air – outdoor (3.6.1-12)	Increased resistance of connection due to the loosening of bolts caused by thermal cycling and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Metal Enclosed Bus	Consistent with the GALL Report
Metal enclosed bus: insulation; insulators composed of porcelain; xenoy; thermo-plastic organic polymers exposed to air – indoor, controlled or uncontrolled or air – outdoor (3.6.1-13)	Reduced insulation resistance due to thermal/ thermoxidative degradation of organics/ thermoplastics, radiation-induced oxidation, moisture/debris intrusion, and ohmic heating	Chapter XI.E4, "Metal Enclosed Bus"	No	Metal Enclosed Bus	Consistent with the GALL Report

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Metal enclosed bus: external surface of enclosure assemblies composed of steel exposed to air – indoor, uncontrolled or air – outdoor (3.6.1-14)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.E4, “Metal Enclosed Bus,” or Chapter XI.S6, “Structures Monitoring”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.1.1)
Metal enclosed bus: external surface of enclosure assemblies composed of galvanized steel; aluminum exposed to air – outdoor (3.6.1-15)	Loss of material due to pitting and crevice corrosion	Chapter XI.E4, “Metal Enclosed Bus,” or Chapter XI.S6, “Structures Monitoring”	No	Metal Enclosed Bus	Consistent with the GALL Report
Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled (3.6.1-16)	Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients	Chapter XI.E5, “Fuse Holders”	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.1.1)
Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, controlled or uncontrolled (3.6.1-17)	Increased resistance of connection due to fatigue caused by frequent manipulation or vibration	Chapter XI.E5, “Fuse Holders” No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms or fatigue caused by frequent manipulation or vibration	No	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.1.1)

Component Group (SRP-LR Item No.)	Aging Effect/ Mechanism	Recommended AMP in SRP-LR	Further Evaluation in SRP-LR	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor, controlled or uncontrolled or air – outdoor (3.6.1-18)	Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Chapter XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	No	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Consistent with the GALL Report
Connector contacts for electrical connectors exposed to borated water leakage composed of various metals used for electrical contacts exposed to air with borated water leakage (3.6.1-19)	Increased resistance of connection due to corrosion of connector contact surfaces caused by intrusion of borated water	Chapter XI.M10, “Boric Acid Corrosion”	No	Not Applicable (PWR Only)	Not Applicable to BWRs (see SER Section 3.6.2.1.1)
Transmission conductors composed of aluminum exposed to air – outdoor (3.6.1-20)	Loss of conductor strength due to corrosion	None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR)	None	Not Applicable	Not Applicable to LSCS (see SER Section 3.6.2.1.1)
Fuse holders (not part of active equipment): insulation material, metal enclosed bus: external surface of enclosure assemblies composed of insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other, galvanized steel; aluminum, steel exposed to air – indoor, controlled or uncontrolled (3.6.1-21)	None	None	NA - No AEM or AMP	Consistent with the GALL Report	Consistent with the GALL Report

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 electrical components:

- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Metal Enclosed Bus

LRA Table 3.6.2-1 summarizes the AMR results for the electrical components and indicates AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency and for which the GALL Report does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components in these GALL Report component groups were bounded by the GALL Report evaluation. The applicant provided a note for each AMR item. The notes describe how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E, which indicate how the AMR was consistent with the GALL Report.

Note A indicates that the AMR 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 audited these AMR items to confirm consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicates that the AMR item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed that it had reviewed and accepted the identified exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified by the GALL Report. Note C indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as those of the component under review. The staff audited these AMR items to confirm consistency with the GALL Report. The staff also determined whether the AMR item of the different component applied 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 item, although different from that in the GALL Report, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these AMR items to confirm consistency with the GALL Report and confirmed whether the AMR item of the different component was applicable to the component under review. The staff confirmed whether it had reviewed and accepted the exceptions to the GALL Report AMPs. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect; however, a different AMP is credited. The staff audited these AMR items to confirm consistency with the GALL Report and determined whether the identified AMP would manage the aging effect consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff did not repeat its review of the matters described in the GALL Report for those items that the staff determined were bounded by the GALL Report evaluation. However, it did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.6.2.1.1 AMR Results Identified as Not Applicable or Not Used

For LRA Table 3.6.1, item 3.6.1-19, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to PWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to PWRs; and finds that these items are not applicable to LSCS, which is a BWR.

For LRA Table 3.6.1, items 3.6.1-14, 3.6.1-16, 3.6.1-17, and 3.6.1-20, the applicant claimed that the corresponding items in the GALL Report are not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at LSCS. The staff reviewed the LRA and UFSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

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 electrical commodity group components and provided information concerning how it will manage the following aging effects:

- electrical equipment subject to EQ
- reduced insulation resistance due to presence of any salt deposits and surface contamination and loss of material due to mechanical wear caused by wind blowing on transmission conductors
- loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of preload
- QA for aging management of nonsafety-related components
- ongoing review of operating experience

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 3.6.2.2. The staff's review of the applicant's further evaluation follows.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

LRA Section 3.6.2.2.1, associated with LRA Table 1, item 3.6.1-1, states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in LRA Section 4.4. This is consistent with SRP-LR Section 3.6.2.2.1 and, therefore, is acceptable. The staff's evaluation of the TLAA for electrical equipment subject to EQ is documented in SER Section 4.4.

3.6.2.2.2 Reduced Insulation Resistance Due to the Presence of Any Salt Deposits and Surface Contamination and Loss of Material Due to Mechanical Wear Caused by Wind Blowing on Transmission Conductors

LRA Section 3.6.2.2.2, associated with LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, addresses high-voltage insulators composed of porcelain, malleable iron, aluminum, galvanized steel, and cement exposed to outdoor air. SRP-LR Section 3.6.2.2.2 states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed and states that acceptance criteria for this further evaluation are described in BTP RLSB-1 (SRP-LR Appendix A.1).

LRA Item 3.6.1-2 addresses the aging effect of loss of material due to mechanical wear caused by wind blowing on transmission conductors. LRA Section 3.6.2.2.2 states that, for high-voltage insulators, mechanical wear and loss of material due to wind and movement of the associated transmission conductor is not a credible aging effect at LSCS and that a plant-specific AMP is not required for this aging effect. The applicant noted in its evaluation that high-voltage insulator wear has not been apparent during routine inspections. The applicant also stated that industry experience has shown that transmission conductors do not normally swing and that movement due to substantial wind will subside after a short period.

The staff noted that EPRI 1013475, "Plant Support Engineering: License Renewal Electrical Handbook, Revision 1, to EPRI Report 1003057," dated February 2007, states that "mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement." Movement of insulators can be caused by wind blowing on the supported transmission conductor, causing it to swing. If this swing is frequent enough, it could cause wear in the metal contact point of the insulator string and between an insulator and supporting hardware. EPRI 1013475 indicates that this mechanism is possible but that industry operating experience has shown that the transmission conductors are designed not to normally swing, and when they do (e.g., due to a substantial wind), transmission conductors do not continue to swing for a long period of time once the wind has subsided.

The staff evaluated the applicant's claim and finds it acceptable because the applicant's further evaluation was performed consistent with SRP-LR Section 3.6.2.2.2 review and acceptance criteria demonstrating that mechanical wear due to wind is not an applicable aging effect for LSCS.

LRA Item 3.6.1-3 addresses the aging effect of reduced insulation resistance due to presence of salt deposits or surface contamination. LRA Section 3.6.2.2.2 states that this item is not applicable because airborne materials can contaminate insulator surfaces but that the buildup of contamination is gradual and is usually removed by rain. The applicant also stated that the glazed surface of the insulator helps in the removal of dust, salt, and industrial effluent contamination. LSCS is not located near the seacoast or near other sources of airborne particulates. Therefore, the applicant concluded that reduced insulation resistance due to surface contamination is not an applicable aging effect for high-voltage insulators at LSCS and that a plant-specific AMP is not required. The applicant cites generic note I and plant-specific note 2 for this item. Note 2 states that based on LSCS design and operating experience, reduced insulation resistance is not an applicable aging effect for LSCS high-voltage insulators.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination. The staff notes that LSCS is not located in the vicinity of salt water bodies or industrial pollution; therefore, surface contamination of high-voltage insulators is minimized. In addition, rainfall and snow periodically wash away minor contamination, and the glazed insulator surface also aids contamination removal.

The staff evaluated the applicant's claim and finds it acceptable because the applicant's evaluation was performed consistent with SRP-LR Section 3.6.2.2.2 review and acceptance criteria and because it demonstrated that a reduced insulation resistance aging effect due to salt deposits or surface contamination of high-voltage insulators is not an applicable aging mechanism requiring management for LSCS.

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Preload

LRA Section 3.6.2.2.3, associated with LRA Table 1, items 3.6.1-4 through 3.6.1-7, addresses loss of material due to wind-induced abrasion, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of preload in transmission conductors and connections and in switchyard bus and connections. The criteria in SRP-LR Section 3.6.2.2.3 recommend further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in BTP RLSB-1 (SRP-LR Appendix A.1).

LRA Item 3.6.1-4 addresses the aging effect of loss of strength due to corrosion in transmission conductors composed of aluminum and steel exposed to outdoor air. LRA Section 3.6.2.2.3 states that loss of conductor strength is not an applicable aging effect for LSCS transmission conductors based on LSCS design and operating experience.

The applicant referenced an Ontario Hydro study that included the results of aluminum conductor steel reinforced (ACSR) transmission conductor laboratory and field tests, including the evaluation of conductor aging effects due to locations near pollution sources and major urban areas. The Ontario Hydro study results indicate acceptable loss of strength due to corrosion in areas affected by industrial pollution. The applicant stated that LSCS is located in a rural area with low industrial airborne particles and, therefore, is bounded by the Ontario Hydro study. The applicant also stated that LSCS transmission conductors are more substantial than conductors evaluated in the above study and, therefore, will have ample strength margin throughout the period of extended operation.

The staff noted that the LSCS ACSR transmission conductors of the in-scope switchyard components are susceptible to loss of strength due to corrosion. However, LSCS is not located in an area affected by industrial airborne particles and is not subject to higher rates of corrosion than those observed by the Ontario Hydro study. Therefore, the staff finds that loss of conductor strength due to corrosion of ACSR transmission conductors is not an applicable aging effect at LSCS requiring an AMP.

LRA Item 3.6.1-5 addresses the aging effect of increased resistance of connection due to oxidation or loss of preload in transmission connectors composed of aluminum and steel exposed to outdoor air. LRA Section 3.6.2.2.3 states that oxidation and loss of preload are not applicable aging effects for LSCS transmission connectors based on LSCS design and operating experience.

Transmission connectors can be susceptible to increased resistance due to corrosion. LSCS air quality, due to its location being away from any industrial facilities and free from salty moisture, is not a contributing factor to aging degradation due to corrosion. At LSCS, transmission connector surfaces are coated with corrosion inhibitors providing a corrosion-resistant low electrical resistance connection. LSCS transmission connectors are designed and installed using stainless steel lock washers and torqued to maintain preload. The design of these connections along with operating experience at LSCS indicates that increased resistance due to general corrosion and oxidation and loss of preload are not AERMs.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's further evaluation acceptable because the LSCS transmission connectors are located in an area away from industrial air pollution; therefore, the aluminum bus material is not expected to exhibit significant aging effects. In addition, the transmission connectors employ corrosion inhibitors and bolting practices using washers that prevent loss of preload and limit vibration.

LRA item 3.6.1-6 addresses the aging effects of loss of material due to wind-induced abrasion, increased resistance of connection due to oxidation, or loss of preload in switchyard bus and connections composed of aluminum, copper, bronze, stainless steel, or galvanized steel exposed to outdoor air. LRA Section 3.6.2.2.3 states that loss of material and increased resistance of connection are not applicable aging effects for LSCS switchyard bus and connections.

Switchyard connections can be susceptible to increased resistance due to corrosion. LSCS air quality, due to its location away from industrial facilities, is not a contributing factor to aging degradation due to corrosion. At LSCS, switchyard connection surfaces are coated with an inhibitor compound providing a corrosion-resistant low electrical resistance connection. Absence of operating experience problems with switchyard buses at LSCS indicates that increased connection resistance due to general corrosion and oxidation is not an AERM.

The applicant stated that due to the design of the transmission switchyard conductors and bus bolted connections, torque relaxation (loss of preload) is precluded. The design calls for use of washers and a corrosion inhibitor to preclude connection degradation due to loss of preload. The operating experience at LSCS has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of transmission conductor connections and switchyard bus connections is not an AERM at LSCS.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's evaluation acceptable because wind-born particulates have not been shown to be a contributor to loss of material at LSCS. The staff also noted that the switchyard bus is connected to active components by short sections of flexible conductors, which dampen the vibration effects caused by operation of switchyard components.

LRA Item 3.6.1-7 addresses the aging effects of loss of material due to wind-induced abrasion in transmission conductors composed of aluminum and steel exposed to outdoor air. LRA Section 3.6.2.2.3 states that loss of material is not an applicable aging effect for LSCS transmission conductors.

The applicant reviewed loss of material (wear) due to wind particulates and concluded that they are not applicable AERMs. The staff noted that wind born particulates have not been shown to be a contributor to loss of material. Therefore, the staff finds that the loss of material (wear) due to wind-induced abrasion is not an AERM for transmission conductors and connections at LSCS.

On the basis of its review, 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 finds 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).

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 QA program.

3.6.2.2.5 Ongoing Review of Operating Experience

SER Section 3.0.5, "Operating Experience for Aging Management Programs," documents the staff's evaluation of the applicant's consideration of operating experience of AMPs.

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 that are not consistent with or are not addressed in the GALL Report.

In LRA Table 3.6.2-1, the applicant indicated, through notes F through J, that the combination of component type, material, environment, and AERM does 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 section.

3.6.2.3.1 Electrical Commodities – Summary of Aging Management Evaluation – LRA Table 3.6.2-1

The staff reviewed LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the Electrical Commodities component groups.

Porcelain, Malleable Iron, Aluminum, Galvanized Steel, and Cement Exposed to Outdoor Air. For the LRA Table 3.6.2-1 item corresponding to LRA Table 1, item 3.6.1-2, the applicant stated that, for high-voltage insulators, mechanical wear, reduced insulation resistance, and loss of material due to wind and movement of the associated transmission conductors is not a credible aging effect at LSCS and that a plant-specific AMP is not required for this aging effect. The applicant cites generic note I and plant-specific note 1 for this item. Note 1 states that based on LSCS design and operating experience, loss of material is not an applicable aging effect for LSCS high-voltage insulators. The applicant noted in its evaluation that high-voltage insulator wear has not been apparent during routine inspections. The applicant also stated that industry experience has shown transmission conductors do not normally swing and movement due to substantial wind will subside after a short period.

The staff reviewed the associated Table 3.6.2-1 item in the LRA to confirm that these aging effects are not applicable for this component, material, and environmental combination. The staff finds that this aging effect is not applicable to LSCS because plant and industry experience has shown that the components are not subject to prolonged movement of transmission conductors.

For the LRA Table 3.6.2-1 item associated with LRA Table 1, item 3.6.1-3, the applicant stated that, for porcelain, malleable iron, aluminum, galvanized steel, and cement exposed to outdoor air, there is no AERM and that no AMP is proposed. The AMR item cites generic note I and plant-specific note 2, which states that, based on LSCS design and operating experience, reduced insulation resistance is not an applicable aging effect for LSCS high-voltage insulators. The applicant stated that there is no aging effect because airborne materials can contaminate insulator surfaces, but the buildup of contamination is gradual and is usually removed by rain. The applicant also stated that the glazed surface of the insulator helps in the removal of dust, salt, and industrial effluent contamination. LSCS is not located near the seacoast or near other sources of airborne particulates.

The staff reviewed the associated items in the LRA and confirmed that there are no credible aging effects for this component, material, and environmental combination because LSCS is not located in the vicinity of salt water bodies or industrial pollution; therefore, surface contamination of high-voltage insulators is minimized. In addition, rainfall and snow periodically wash away minor contamination, and the glazed insulator surface also aids contamination removal.

Aluminum and Steel Exposed to Outdoor Air. For the LRA Table 3.6.2-1 item associated with Table 1, item 3.6.1-4, the applicant stated that, for transmission conductors composed of aluminum and steel exposed to outdoor air, there is no aging effect and that no AMP is proposed. The AMR item cites generic note I and plant-specific note 5, which states that loss of conductor strength is not an applicable aging effect for LSCS transmission conductors, based on LSCS design and operating experience.

The applicant referenced the Ontario Hydro study that included the results of ACSR transmission conductor laboratory and field tests, including the evaluation of conductor aging effects due to locations near pollution sources and major urban areas. The Ontario Hydro study results indicate acceptable loss of strength due to corrosion in areas affected by industrial pollution. The conductors studied were of similar material but were less substantial in size and construction than those used at LSCS.

The applicant stated that LSCS is located in a rural area with low industrial airborne particles and, therefore, is bounded by the Ontario Hydro study. The applicant also stated that LSCS transmission conductors are more substantial than conductors evaluated in the above study and, therefore, will have ample strength margin throughout the period of extended operation.

The staff noted that the LSCS ACSR transmission conductors of the in-scope switchyard components are susceptible to loss of strength due to corrosion. However, LSCS is not located in an area affected by industrial airborne particles and is not subject to higher rates of corrosion than that observed by the Ontario Hydro study. The staff also noted that ACSR transmission conductors used at LSCS are more substantial than the material for the Ontario Hydro study and, therefore, are bound by the results of this study. Therefore, the staff finds that loss of conductor strength due to corrosion of ACSR transmission conductors is not an applicable aging effect at LSCS requiring an AMP.

For the LRA Table 3.6.2-1 item associated with Table 1, item 3.6.1-7, the applicant stated that, for transmission conductors composed of aluminum and steel exposed to outdoor air, there is no aging effect and that no AMP is proposed. The AMR item cites generic note I and plant-specific note 4, which states that LSCS transmission conductors composed of aluminum and steel in an outdoor air environment are not subject to wind-induced abrasion leading to loss of material.

The staff reviewed the associated items in the LRA to confirm that this aging effect is not applicable for this component, material, and environmental combination. The staff finds the applicant's evaluation acceptable because wind-born particulates have not been shown to be a contributor to loss of material. Therefore, the staff finds that the loss of material (wear) due to wind-induced abrasion is not a significant AERM for transmission conductors and connections at LSCS.

Stainless Steel Exposed to Outdoor Air. For the LRA Table 3.6.2-1 item associated with Table 1, item 3.6.1-5, the applicant stated that, for transmission connectors composed of stainless steel exposed to outdoor air, there is no aging effect and that no AMP is proposed. The AMR item cites generic note I and plant-specific note 6, which states that in-scope LSCS transmission connectors composed of stainless steel in an outdoor air environment are not subject to oxidation or loss of preload and that increased resistance of connection is not an applicable aging effect.

Switchyard connections can be susceptible to increased resistance due to corrosion. LSCS air quality, due to its location being away from any industrial facilities and free from salty moisture, is not a contributing factor to aging degradation due to corrosion. At LSCS, switchyard connection surfaces are coated with corrosion inhibitors, providing a corrosion-resistant low electrical resistance connection. LSCS transmission connectors are designed and installed using stainless steel lock washers and torqued to maintain preload. The design of these connections along with operating experience at LSCS indicates that increased resistance due to general corrosion and oxidation and loss of preload are not AERMs.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination because transmission connectors are designed and installed using stainless steel lock washers and are torqued to maintain preload and because switchyard connections employ corrosion inhibitors and good bolting practices that prevent loss of preload and limit vibration.

Aluminum and Stainless Steel Exposed to Outdoor Air. For the LRA Table 3.6.2-1 item associated with Table 1, item 3.6.1-6, the applicant stated that, for switchyard bus and connections composed of aluminum and stainless steel exposed to outdoor air, there is no aging effect and that no AMP is proposed. The AMR item cites generic note I and plant-specific note 3, which states that in-scope switchyard bus and connections composed of aluminum and stainless steel in an outdoor air environment are not subject to wind induced abrasion, oxidation, or loss of preload and that loss of material and increased resistance of connection are not applicable aging effects.

Switchyard connections can be susceptible to increased resistance due to corrosion. LSCS air quality, due to its location away from industrial facilities, is not a contributing factor to aging degradation due to corrosion. At LSCS, switchyard connection surfaces are coated with an inhibitor compound, providing a corrosion-resistant low electrical resistance connection. The absence of operating experience problems with switchyard buses at LSCS indicates that increased connection resistance due to general corrosion and oxidation is not an AERM.

The applicant stated that, due to the design of the transmission switchyard conductors and bus bolted connections, torque relaxation (loss of preload) is precluded. The design calls for use of washers and corrosion inhibitor to preclude connection degradation due to loss of preload. The operating experience at LSCS has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of transmission conductor connections and switchyard bus connections is not an AERM at LSCS.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environmental combination. The staff finds the applicant's evaluation acceptable because wind-born particulates have not been shown to be a contributor to loss of material at LSCS. The staff also noted that the switchyard bus is connected to active components by short sections of flexible conductors, which dampen the vibration effects caused by operation of switchyard components. In addition, switchyard connections employ corrosion inhibitors and bolting practices using washers that prevent loss of preload and limit vibration. Therefore, the staff concludes that abrasion, corrosion, oxidation, and loss of preload are not considered an applicable aging mechanism for switchyard bus and connections at LSCS.

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical 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).

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.” On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects 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 UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, 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 that any changes made to the CLB to comply with 10 CFR 54.21(a)(3) are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section of the safety evaluation report (SER) provides the staff's evaluation of the Exelon Generation Company, LLC (Exelon or the applicant) basis for identifying those plant-specific or generic analyses that need to be identified as time-limited aging analyses (TLAAs) for the applicant's license renewal application (LRA) and the list of TLAAs for the LRA. The TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. This section of the SER also provides the staff's evaluation of the applicant's basis for identifying those exemptions that need to be identified in the LRA.

In accordance with the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 54.21(c)(1)), an applicant for license renewal must list all evaluations, analyses, and calculations in the current licensing basis (CLB) that conform to the definition of a TLAA, as defined in 10 CFR 54.3, "Definitions."

The regulation at 10 CFR 54.3 states that a plant-specific or generic evaluation, analysis, or calculation is a TLAA if it meets all six of the following TLAA identification criteria:

(1) involves a system, structure, or component (SSC) that is within the scope of a LRA, as described in 10 CFR 54.4(a)

(2) considers the effect or effects of aging

(3) involves time-limited assumptions that are defined by the current operating term (e.g., 40 years)

(4) was determined to be relevant by the applicant in making a safety determination

(5) involves conclusions, or provides the basis for conclusions, related to the capability of the SSC to perform its intended function(s), as described in 10 CFR 54.4(b)

(6) is contained or incorporated by reference in the CLB

For each evaluation, analysis, or calculation that is a TLAA, the applicant must demonstrate that the TLAA will be acceptable for the period of extended operation in accordance with one of the following three acceptance criteria for TLAAs in 10 CFR 54.21(c)(1):

(i) The analysis will remain valid for the period of extended operation.

(ii) The analysis has been projected to the end of the period of extended operation.

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list all plant-specific exemptions in the CLB that were granted in accordance with the exemption approval criteria in 10 CFR 50.12, "Specific Exemptions," and that are based on a TLAA. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

The staff's guidance for reviewing LRA Section 4.1 is provided in NUREG–1800, Revision 2, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants – Final Report” (SRP-LR), dated December 2010, Section 4.1, “Identification of Time Limiting Aging Analyses.” SRP-LR Section 4.1.1 summarizes the areas of review. SRP-LR Section 4.1.2 provides the staff’s “acceptance criteria” for performing TLAA and LRA exemption identification reviews. SRP-LR Section 4.1.3 provides the staff’s “review procedures” for performing the TLAA and LRA exemption identification reviews.

SPR-LR Table 4.1-1 provides some case-by-case examples on whether a given analysis category would be required to be identified as a TLAA for an LRA. SPR-LR Table 4.1-2 provides a list of those analyses or calculations that are normally part of an applicant’s CLB and that are normally identified as TLAAs (i.e., generic TLAAs). SPR-LR Table 4.1-3 provides a list of those analyses or calculations that may be identified as plant-specific TLAAs.

4.1.1 Summary of Technical Information in the Application

4.1.1.1 Identification of TLAAs

LRA Section 4.1 states that the applicant reviewed and evaluated the evaluations, analyses, and calculations in the CLB for LaSalle County Station, Units 1 and 2 (LSCS), against the six criteria for TLAAs in 10 CFR 54.3. The applicant stated that it used the following guidance documents as part of the bases for its TLAA identification methodology: (1) SRP-LR, (2) NUREG-1801, Revision 2, “Generic Aging Lessons Learned (GALL) Report,” dated December 2010, (3) NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule,” (4) the NRC’s Statement of Consideration on 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” and (5) prior LRAs, including NRC requests for additional information (RAIs) and SER inputs that have been issued for these applications.

The applicant stated that its review of the CLB included a review of the following plant-specific or generic sources (documents or records): (1) updated final safety analysis report (UFSAR), (2) Technical Specifications (TS) and Bases, (3) docketed licensing correspondence, (4) NRC SERs, (5) applicable reports or design analyses, including those developed by Combustion Engineering (CE), Chicago Bridge and Iron Co. (CB&I), General Electric (GE), General Electric-Hitachi (GEH), Sargent and Lundy, and other vendors, (6) Passport records, (7) environmental qualification (EQ) binders, (8) applicable specifications, (9) engineering change requests, (10) corrective action program reports, (11) self-assessment reports, (12) 10 CFR 50.12 exemption requests, and (13) inspection relief requests.

The applicant provides its list of TLAAs in LRA Table 4.1-2, “Summary of Results – LSCS Time-Limited Aging Analyses”:

- Reactor Vessel and Internals Neutron Embrittlement Analyses in LRA Section 4.2, including those in the following subsections:
  - LRA Section 4.2.1, Neutron Fluence Analyses
  - LRA Section 4.2.2, Upper-Shelf Energy Analyses
  - LRA Section 4.2.3, Adjusted Reference Temperature Analyses
  - LRA Section 4.2.4, Pressure-Temperature Limits
  - LRA Section 4.2.5, Axial Weld Failure Probability Assessment Analyses

- LRA Section 4.2.6, Circumferential Weld Failure Probability Assessment Analyses
- LRA Section 4.2.7, Reactor Pressure Vessel Reflood Thermal Shock Analysis
- LRA Section 4.2.8, RPV Core Plate Rim Hold-Down Bolt Loss of Preload Analysis
- LRA Section 4.2.9, Jet Pump Riser Brace Clamp Loss of Preload Analysis
- LRA Section 4.2.10, Jet Pump Slip Joint Repair Clamp Loss of Preload Analysis

- Metal Fatigue Analyses in LRA Section 4.3, including those in the following subsections:
  - LRA Section 4.3.1, ASME Section III, Class 1 Fatigue Analyses
  - LRA Section 4.3.2, ASME Section III, Class 2 and 3 and ANSI B31.1 Allowable Stress Analyses
  - LRA Section 4.3.3, Environmental Fatigue Analyses for RPV and Class 1 Piping
  - LRA Section 4.3.4, Reactor Vessel Internals Fatigue Analyses
  - LRA Section 4.3.5, High-Energy Line Break (HELB) Analyses Based on Fatigue
  - LRA Section 4.3.6, Main Steam Relief Valve Discharge Piping Fatigue Analyses
- Environmental Qualification (EQ) for Electrical Components in LRA Section 4.4
- Concrete Containment Tendon Prestress Analyses in LRA Section 4.5
- Primary Containment Fatigue Analyses in LRA Section 4.6, including those in the following subsections:
  - LRA Section 4.6.1, Primary Containment Liner and Penetrations Fatigue Analyses
  - LRA Section 4.6.2, Primary Containment Refueling Bellows Fatigue Analysis
  - LRA Section 4.6.3, Primary Containment Downcomer Vents Fatigue Analysis
- Other Plant-Specific TLAAs in LRA Section 4.7, including those in the following subsections:
  - LRA Section 4.7.1, Reactor Building Crane Cyclic Loading Analysis
  - LRA Section 4.7.2, Main Steam Line Flow Restrictors Erosion Analysis

The applicant provides its bases for accepting these TLAAs in accordance with either 10 CFR 54.21(c)(1)(i), (ii), or (iii) in the applicable subsections of LRA Sections 4.2 through 4.7.

The applicant indicated that the following analysis listed in SRP-LR Table 4.1-2 is not part of the LSCS CLB and therefore does not need to be identified as an applicable TLAA for the LRA:

- inservice local metal containment corrosion analyses

The applicant indicates that the following potentially applicable plant-specific evaluations, analyses, or calculations listed in SRP-LR Table 4.1-3 are not part of the LSCS CLB and, therefore, do not need to be identified as applicable TLAAs for the LRA:

- intergranular separation in the heat-affected zone (HAZ) of reactor vessel low-alloy steel under austenitic stainless steel cladding (i.e., reactor pressure vessel (RPV) underclad cracking analysis)
- low-temperature overpressure [protection] (LTOP) analysis

- fatigue analysis for main steam supply lines to the auxiliary feedwater (AFW) pumps
- fatigue analysis for reactor coolant pump (RCP) flywheel
- flow-induced vibration endurance limit for the reactor vessel internals
- ductility reduction of fracture toughness analysis for the reactor vessel internals
- leak before break (LBB)
- metal corrosion allowance
- inservice flaw growth analyses that demonstrate structure stability for 40 years

4.1.1.2 Identification of Regulatory Exemptions

The applicant stated that it reviewed the CLB to determine whether there were any exemptions for the CLB that were granted in accordance with 10 CFR 50.12 and that are based on a TLAA, as required by 10 CFR 54.21(c)(2). The applicant stated that it did not identify any exemptions for the CLB that were granted in accordance with 10 CFR 50.12 and that are based on a TLAA.

4.1.2 Staff Evaluation

4.1.2.1 Identification of TLAAs

The staff reviewed the applicant's methodology for identifying the TLAAs and the TLAA results for the LRA against the six criteria for TLAA identification in 10 CFR 54.3 and the list of TLAAs in SRP-LR Section 4.1, including the analyses in SRP-LR Table 4.1-2 that are normally generic TLAAs for the U.S. nuclear power industry and the list of analyses in SRP-LR Table 4.1-3 that may be plant-specific TLAAs. The staff used the "acceptance criteria" in SRP-LR Section 4.1.2 and the review procedures in SRP-LR Section 4.1.3 as the basis for its review.

To verify the completeness of the applicant's list of TLAAs, the staff reviewed LRA Appendix C, "Response to BWRVIP Applicant Action Items," which provides the applicant's responses to those applicant action items (AAIs) that were issued by the NRC on the applicant's bases for implementing specific EPRI BWRVIP technical report methodologies during the period of extended operation. This review is provided in SER Section 4.1.2.1.2. SER Section 3.0.3.2.3 provides the staff's evaluations of the AAI responses that were provided in the LRA for non-TLAA-related topics.

4.1.2.1.1 Evaluations, Analyses, and Calculations in the CLB Conforming to 10 CFR 54.3 TLAA Criteria

LRA Table 4.1-1 identifies those generic analyses and plant-specific analyses in the CLB that have been identified as TLAAs for the LRA. The staff noted that these are the analyses that have been identified as TLAAs in SER Section 4.1.1.1 and that these analyses are in conformance with the six criteria for defining TLAAs in 10 CFR 54.3. Based on this review, the staff finds that the identification of these TLAAs is acceptable because it is in compliance with the requirement in 10 CFR 54.21(c)(1). The staff's evaluation of the applicant's basis for accepting these TLAAs in accordance with either 10 CFR 54.21(c)(1)(i), (ii), or (iii) is documented in SER Sections 4.2 through 4.7 and their subsections.

4.1.2.1.2 Evaluation of Plant Evaluations, Analyses, and Calculations in the CLB that Do Not Conform to the Definition of a TLAA in 10 CFR 54.3 or Statements that a Particular Analysis Referenced in the SRP-LR Does Not Exist in the CLB (Evaluation of "Absence of TLAA" Bases)

Absence of a TLAA – Inservice Local Metal Containment Corrosion Analyses. LRA Table 4.1-1 identified that the CLB does not include any corrosion analyses for the metallic containment liner or other metallic containment components that conform to the definition of a TLAA in 10 CFR 54.3(a) and that would need to be identified as TLAAs for the LRA in accordance with 10 CFR 54.21(c)(1).

SRP-LR Table 4.1-2 identifies a local metal containment corrosion analysis as a generic type of TLAA that may be generically applicable to an applicant's plant design. SRP-LR Section 4.7 provides the staff's recommended criteria for accepting these types of TLAAs in accordance with the TLAA acceptance requirements in 10 CFR 54.21(c)(1)(i), (ii), or (iii).

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff verified that the UFSAR does not rely on localized metal corrosion analyses to justify the structural integrity of metallic containment components against the consequences of corrosion-induced aging effects. Therefore, the staff concludes that LRA does not need to include a localized metal containment corrosion TLAA because the CLB does not include a localized metal containment structure corrosion analysis.

Absence of a TLAA –Intergranular Separation in the HAZ of reactor vessel low-alloy steel under austenitic SS cladding. LRA Table 4.1-1 identified that the CLB does not include any cycle-dependent analysis in evaluation of intergranular separations (underclad cracks/underclad cracking) in RPV cladding-to-forging welds.

SRP-LR Table 4.1-3 identifies that the CLB may include a plant-specific RPV underclad cracking analysis that qualifies as a TLAA. The recommended guidance in SRP-LR Section 3.1.2.2.5 and AMR item 18 in SRP-LR Table 3.1-1 identifies that these types of TLAAs are only applicable to SA-508 Class 2 forgings in pressurized water reactor (PWR)-designed RPVs that were welded to the RPV cladding using an uncontrolled high heat weld input process, and do not apply to boiling water reactors (BWRs).

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE-designed BWR Model 5 reactors. Therefore, consistent with the evaluation that is given in SER Section 3.1.2.2.5, the staff concludes that the LRA does not need to include a plant-specific RPV underclad cracking TLAA because the reactors at LSCS are BWRs.

Absence of a TLAA – LTOP Analysis. LRA Table 4.1-1 identified that the CLB does not include an LTOP analysis for the RPV and reactor coolant pressure boundary (RCPB).

SRP-LR Table 4.1-3 identifies that the CLB may include a plant-specific LTOP analysis that qualifies as a TLAA. The relevant SRP-LR recommendations are only applicable to the LTOP systems in PWR designs. The SRP-LR guidance is not applicable to BWR designs because BWR plants are not designed with LTOP systems.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE-designed

BWR Model 5 reactors. Therefore, the staff concludes that the LRA does not need to include a plant-specific LTOP TLAA because the reactors at LSCS are BWRs.

Absence of a TLAA – Fatigue Analysis for Main Steam Supply Lines to Steam-Driven Auxiliary Feedwater Pumps. LRA Table 4.1-1 identified that the CLB does not include a fatigue analysis for main steam lines that supply steam to steam-driven AFW pumps.

SRP-LR Table 4.1-3 identifies that the CLB may include a plant-specific metal fatigue analysis for AFW pump main steam supply lines that qualifies as a TLAA. The relevant SRP-LR recommendations are only applicable to PWRs with designs that include steam-driven AFW pumps. The SRP-LR guidance is not applicable to BWR designs because BWR designs are not designed with AFW systems or pumps.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE-designed BWR Model 5 reactors. Therefore, the staff concludes that the LRA does not need to include a plant-specific fatigue TLAA for steam-driven AFW pump steam supply lines because the reactors at LSCS are BWRs.

Absence of a TLAA – Fatigue Analysis for the Reactor Coolant Pump Flywheel. LRA Table 4.1-1 identified that the CLB does not include a fatigue analysis for RCP flywheels.

SRP-LR Table 4.1-3 identifies that the CLB may include a plant-specific cycle-dependent fatigue or flaw tolerance analysis for RCP flywheels that qualifies as a TLAA. The SRP-LR recommendations are only applicable to RCP flywheels in PWR designs. The relevant SRP-LR guidance is not applicable to BWR designs because the analogous pump components in BWR designs (i.e., the recirculation pumps) are not designed with flywheels.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE-designed BWR Model 5 reactors. Therefore, the staff concludes that the LRA does not need to include a plant-specific RCP flywheel TLAA because LSCS is a BWR.

Absence of a TLAA – Flow-Induced Vibration Limit for Reactor Vessel Internals. LRA Table 4.1-1 identified that the CLB does not include any TLAA associated with a flow-induced vibration limit for RVI components at LSCS.

SRP-LR Table 4.1-3 identifies that the CLB may include plant-specific flow-induced vibration analyses for the RVI components that qualify as TLAAs.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that UFSAR Section 3.9.2.4 indicates that flow-induced vibrations of the RVI components were assessed as part of a preoperational testing program and that the results of the program were summarized in GE Report NEDO-24057-P, "Assessment of Reactor Internals Vibration in BWR/4 and BWR/5 Plants," dated November 1977. However, the staff noted that the UFSAR did not indicate whether the methodology in GE Report NEDO-24057-P included a time-dependent analysis for qualifying the structural integrity of the RVI components against the consequences of age-related effects caused by flow-induced vibrations.

By letter dated July 7, 2015, the staff issued RAI 4.1-1, requesting that the applicant clarify whether the methodology in GE Report NEDO-24057-P included a time-dependent analysis and, if so, whether the analysis is relied upon to qualify the structural integrity of the RVI components against the consequences of flow-induced vibrations. If the analysis is time-dependent, the staff asked the applicant to provide justification as to why it would not need to be identified as a TLAA when compared to the six criteria for TLAAs in 10 CFR 54.3(a).

The applicant responded to RAI 4.1-1 in a letter dated August 6, 2015. The applicant stated that GE Report NEDO-24057-P was the GE licensing report that provides the analytical bases for the reactor internals vibration assessment program, including its acceptance criteria. The applicant stated that the report uses a combination of pretest analysis of predicted vibrations, vibrational monitoring during flow testing, and post-test inspection of the RVI components to qualify the components against the consequences of age-related effects that could potentially be induced by flow-induced vibrations. The applicant stated that analysis in the report does not include any time-dependent vibration assumptions, and instead places a maximum limit on the alternating stress amplitude of the flow-induced vibrations as an acceptance criterion for the vibration testing.

The staff noted that the applicant's response to RAI 4.1-1 demonstrates that the analysis in GE Report NEDO-24057-P uses a non-time-dependent acceptance criterion (i.e., by establishing a maximum limit on the alternating stress amplitude for flow-induced vibrations) as the basis for demonstrating that flow-induced vibrations will be less than the endurance limit for inducing high cycle fatigue in the RVI components. Therefore, the staff concludes that the applicant has provided sufficient demonstration that the analysis in GE Report NEDO-24057-P does not need to be identified as a TLAA because the applicant has demonstrated that the analysis is not based on time-limited assumptions defined by the current operating term, and this demonstrates that the analysis does not conform to Criterion 3 in 10 CFR 54.3(a) for defining an analysis as a TLAA. RAI 4.1-1 is resolved.

<u>Absence of a TLAA – Reduction of Ductility Fracture Toughness Analysis for the Reactor Vessel Internals</u>. LRA Table 4.1 1 identified that the CLB does not include a reduction of ductility fracture toughness analysis for the RVI components at LSCS.

SRP-LR Table 4.1 3 identifies that the CLB may include a plant-specific reduction of ductility fracture toughness analysis for the RVI components that qualifies as a TLAA. The SRP-LR recommendations are only applicable to RVI components in PWRs designed by the Babcock and Wilcox Company (B&W). The relevant SRP-LR guidance is not applicable to RVI components in U.S. BWR designs because the components were not designed by B&W.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE designed BWR Model 5 reactors. Therefore, the staff concludes that the LRA does not need to include a reduction of ductility fracture toughness TLAA because LSCS is a BWR.

<u>Absence of a TLAA – Leak before Break Analysis</u>. LRA Table 4.1-1 identified that the CLB does not include any TLAA associated with an LBB analysis for the reactor units at LSCS.

SRP-LR Table 4.1-3 identifies that the CLB may include a plant-specific LBB analysis that qualifies as a plant-specific TLAA for the applicant's LRA. The use of LBB technology is only applicable to the evaluation of large bore, high-energy piping in the RCPB (i.e., high-energy, large bore Class 1 piping) of PWR designs. The use of LBB technology has yet to be approved for BWR facilities.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR defines the reactors at LSCS as GE-designed BWR Model 5 reactors. The staff also verified that LBB technology has not been approved in the CLB as the basis for demonstrating compliance with General Design Criterion 4, "Environmental and Dynamic Effects Design Bases," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Instead, the staff verified that the applicant accomplishes this design basis objective through performance of the applicant's HELB analysis for the RCPB system, which is the topic of the TLAA in LRA Section 4.3.5.

Therefore, the staff concludes that the LRA does not need to include an LBB TLAA because the reactor units at LSCS are BWRs and because LBB technology has not been approved as part of the CLB for LSCS. The staff evaluates the TLAA for the LSCS HELB analyses in SER Section 4.3.5.

Absence of a TLAA – Metal Corrosion Allowance Analysis. In LRA Table 4.1-1, the applicant identified that the CLB does not include any TLAA associated with a metal corrosion allowance at LSCS.

SRP-LR Table 4.1-3 identifies that the CLB may include plant-specific metal component corrosion allowance analyses that qualify as TLAAs for the applicant's LRA.

The staff reviewed the information in the UFSAR for relevancy to the applicant's "absence of a TLAA" basis. The staff noted that the UFSAR indicates that corrosion allowances were included in the design for carbon steel and low-alloy steel components based on their exposure to water or steam environments. The staff also noted that the UFSAR does not identify that these metal corrosion allowances (i.e., an additional metal that was included in thickness of the components) were included in component designs as a result of a time-dependent analysis. Therefore, based on this assessment, the staff concludes that the applicant had provided an acceptable basis for concluding that the CLB does not include any corrosion allowance TLAAs because the staff has confirmed that the metal corrosion allowances were not included in the plant design based on the conclusion of a time-dependent analysis result.

Absence of a TLAA – Inservice Flaw Analyses that Demonstrate Structure Stability for 40 Years. LRA Table 4.1-1 states that the CLB does not include any TLAA associated with inservice flaw growth analyses that are used to demonstrate structure stability for 40 years of operation.

SRP-LR Table 4.1-3 identifies that the CLB may include inservice inspection flaw analyses that are used to demonstrate structural stability over a 40-year licensed life.

During the aging management program audit of March 30, 2015, through April 3, 2015, the staff reviewed whether the CLB included any inservice flaw growth or fracture mechanics evaluations that would fall into this category. The staff did not identify any time-dependent flaw analyses that would qualify as a TLAA in accordance with the definition of a TLAA in 10 CFR 54.3(a). Therefore, based on the audit review, the staff concludes the applicant has adequately demonstrated that the CLB does not include any time-dependent flaw analyses that would need to be identified as TLAAs for the LRA.

Potentially Applicable TLAAs Based on the Electric Power Research Institute (EPRI) Boiling Water Reactor Vessel and Internals Project (BWRVIP) Applicant Action Items. The staff noted that inclusion of LRA Aging Management Program (AMP) B.2.1.9, "BWR Vessel Internals," confirms that the applicant applies the BWRVIP inspection and flaw evaluation (I&FE) guideline reports as part of its basis for managing the aging effects that are applicable to the RVI components at LSCS. Therefore, the staff reviewed the NRC-issued safety evaluations (SEs) on the BWRVIP reports that are referenced in GALL Report AMPs XI.M4, "BWR Vessel ID Attachment Welds"; XI.M8, "BWR Vessel Penetrations"; and XI.M9, "BWR Vessel Internals," to determine whether SEs included applicable TLAA-related AAIs for the specific RVI components within the scope of the BWRVIP reports. The staff's review included the following BWRVIP report SEs:

- SE on BWRVIP-18-A (I&FE guidelines for BWR core spray internals)
- SE on BWRVIP-25 (I&FE guidelines for BWR core plates)
- SE on BWRVIP-26-A (I&FE guidelines for BWR top guides)
- SE on BWRVIP-27-A (I&FE guidelines for BWR standby liquid control/core ΔP (SLC/core ΔP) nozzles and lines)
- SE on BWRVIP-38 (I&FE guidelines for core shroud supports)
- SE on BWRVIP-41 (I&FE guidelines for jet pump assembly components)
- SE on BWRVIP-42-A (I&FE guidelines for BWR low-pressure coolant injection (LPCI) couplings)
- SE on BWRVIP-47-A (I&FE guidelines for BWR RVI lower plenum components)
- SE on BWRVIP-48-A (I&FE guidelines for BWR vessel ID attachment welds)
- SE on BWRVIP-49-A (I&FE guidelines for BWR instrument penetrations)
- SE on BWRVIP-74-A (I&FE guidelines for BWR RPV components)
- SE on BWRVIP-76-A (I&FE guidelines for BWR core shrouds)

The staff noted that, of these reports, only BWRVIP-18-A, BWRVIP-25, BWRVIP-26-A, BWRVIP-27-A, BWRVIP-42-A, BWRVIP-47-A, BWRVIP-74-A, and BWRVIP-76-A include AAIs that relate to the identification of TLAAs.

AAI No. 4 on BWRVIP-18-A (BWRVIP I&FE Guidelines for Internal BWR Core Spray Lines)

In the staff's SE on EPRI BWRVIP-18-A dated December 7, 2000, the staff issued AAI No. 4, requesting that BWR applicants identify any plant-specific TLAAs that may be applicable to the evaluation of BWR core spray line (internal portions) and sparger components. Specifically, in this AAI, the staff stated that BWR applicants for renewal should identify all TLAAs that are applicable to the design of its core spray internal components.

In its response to this AAI, the applicant stated that the evaluation of cumulative fatigue damage is a potential TLAA for the core spray system piping and components that are located internal to the RPV. The applicant stated that its evaluation of the fatigue analysis for these components is given in LRA Section 4.3.4. The staff confirmed that the applicant discusses its metal fatigue TLAA (i.e., cumulative usage factor (CUF) analysis) for the internal portion of the core spray line and core spray sparger in LRA Section 4.3.4 and in LRA Table 4.3.4-1. The staff also verified that the fatigue analysis for the internal portions of the core spray lines and spargers was the only analysis for these components that conformed to the definition of a TLAA.

Based on this review, the staff finds the applicant's response to this AAI to be acceptable because the staff has confirmed that the applicant has included the applicable fatigue TLAA for the core spray line and sparger components in the LRA and that the design basis does not include any other analysis that needs to be identified as a TLAA for these components. The staff evaluates the CUF analysis for the internal portions of the core spray line and the core spray sparger in SER Section 4.3.4.2. AAI No. 4 on the BWRVIP-18-A report is resolved with respect to the contents of the LRA.

AAI No. 4 on BWRVIP-25 (BWRVIP I&FE Guidelines for BWR Core Plates)

In the staff's SE on EPRI BWRVIP-25 dated December 7, 2000, the staff issued AAI No. 4, requesting that BWR applicants identify any plant-specific TLAAs that may be applicable to the evaluation of BWR core plate assemblies or the components in these assemblies. Specifically, in this AAI, the staff stated that BWR applicants for license renewal should identify and evaluate whether the evaluation of stress relaxation in core plate rim hold-down bolts should be identified as a TLAA for the components.

In its response to this AAI, the applicant stated that a preload of the rim hold-down bolts is required to prevent lateral motion of the core plate for those plants that do not have core plate wedges installed in the design of their core plate assemblies. The applicant stated that the CLB includes an analysis of loss of preload due to stress relaxation of the core plate rim hold-down bolts and that this analysis is identified as a TLAA for the LRA. The applicant stated that the applicable TLAA is evaluated in LRA Section 4.2.8.

The staff confirmed that the applicant discusses the applicable TLAA for the core plate rim hold-down bolts in LRA Section 4.2.8 and that this TLAA evaluates the percent-drop that will occur in the preload levels of these bolts as a result of irradiation-influence stress relaxation. The staff also verified that, in addition to this TLAA, the LRA also includes a metal fatigue analysis for the core plate assembly, which has been identified as a TLAA in LRA Section 4.3.4.

Based on this review, the staff finds the applicant's response to this AAI to be acceptable because the staff has confirmed that the LRA includes both the TLAA that evaluates loss of preload in the core plate rim hold-down bolts and the TLAA that evaluates cracking due to metal fatigue in the core plate assembly. The staff verified that, in addition to these TLAAs, there are no other analyses for the core plate assembly that would need to be identified as TLAAs for the LRA in accordance with 10 CFR 54.21(c)(1). The staff evaluates the TLAA for the core plate rim hold-down bolts in SER Section 4.2.8. The staff evaluates the metal fatigue analysis for the core plate in SER Section 4.3.4. AAI No. 4 on the BWRVIP-25 report is resolved with respect to the contents of the LRA.

AAI No. 4 on BWRVIP-26-A (BWRVIP I&FE Guidelines for BWR Top Guide Assemblies)

In the staff's SE on EPRI BWRVIP-26-A, dated December 7, 2000, the staff issued AAI No. 4, requesting that BWR applicants identify any plant-specific TLAAs that may be applicable to the evaluation of BWR top guide components. Specifically in this AAI, the staff stated that BWR applicants for license renewal should identify and evaluate the impact of accumulated neutron fluence on the potential to initiate irradiation-assisted stress corrosion cracking (IASCC) in BWR top guide components and should evaluate the basis for identifying this evaluation as a TLAA for the top guide components.

In its response to this AAI, the applicant stated that the Radiation Analysis Modeling Application (RAMA) code fluence evaluation for the RVI components determined that the neutron fluence threshold for IASCC susceptibility of the top guides has been exceeded. The applicant stated that the fluence for RVI components is evaluated as a TLAA in LRA Section 4.2.1. The applicant stated that no other TLAA has been identified to manage the effects of aging for the top guides and their components. The applicant also stated that, during the period of extended operation, the aging of the top guide will be managed by inspections that are conducted as part of the BWRVIP (LRA Section B.2.1.9) and that the AMP will implement inspections of the top guide assemblies and their components consistent with the guidelines in EPRI BWRVIP-183.

The staff confirmed that the applicant does evaluate the neutron fluence methodology for RPV and RVI components in LRA Section 4.2.1. The staff also confirmed that LRA Section 4.3.4 includes the applicant's TLAA of fatigue-induced cracking in the top guide assemblies. The staff evaluates the TLAA for the neutron fluence methodology in SER Section 4.2.1. The staff evaluates the metal fatigue TLAAs for the RVI components (including those for the top guide assemblies) in SER Section 4.3.4.

The staff noted, however, that the applicant's response to AAI No. 4 on the BWRVIP-26-A report did not specifically state whether the CLB included any analysis of irradiation-induced or irradiation-assisted stress corrosion cracking in the top guide assemblies (or the subcomponents in the top guide assemblies) that would need to be identified as a TLAA for the LRA. By letter dated July 7, 2015, the staff issued RAI 4.1-2, requesting that the applicant address this issue. Specifically, the staff asked the applicant whether the CLB includes an analysis or evaluation of irradiation-induced or irradiation-assisted stress corrosion cracking in the top guide assemblies of the reactor units or their subcomponents and, if so, whether the analysis would need to be identified as a TLAA when compared to the six criteria for defining analyses as TLAAs in 10 CFR 54.3(a).

The applicant responded to RAI 4.1-2 in a letter dated August 6, 2015. The applicant stated that, because AAI No. 4 for the BWRVIP-26-A report identified top guide IASCC as a potential TLAA area, the applicant performed specific searches of the CLB records to identify any plant-specific TLAA associated with IASCC of the top guide assemblies. The applicant stated that the only analysis of top guide IASCC found was in Appendix A to EPRI BWRVIP-183, "Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines."

The applicant stated that this appendix provides a flaw evaluation of the grid beam locations in the top guide of a BWR-5 reactor at another plant site. The applicant stated that, although the flaw evaluation was based on time-dependent assumptions, it only assessed the progression of IASCC-induced flaws over a 10-year inservice inspection period. Therefore, the applicant concluded that the analysis does not conform to the definition of a TLAA because it is not based on time-limited assumptions defined by the current operating period (e.g., 40 years).

The staff noted that the applicant's response to RAI 4.1-2 demonstrates that the one analysis in the CLB that applies to the top guide assemblies (i.e., the generic flaw evaluation for top guide grid beam locations) is not based on any time-limited assumptions defined by the current operating term because the time dependency of the analysis is based on a period that is less than a 40-year design life.

Based on this review, the staff concludes that the applicant has provided sufficient demonstration that the generic flaw analysis in the BWRVIP-183 report does not need to be identified as a TLAA because the applicant has demonstrated that the analysis is not based on time-limited assumptions defined by the current operating term, and this demonstrates that the analysis does not conform to Criterion 3 in 10 CFR 54.3(a) for defining an analysis as a TLAA. RAI 4.1-2 is resolved. AAI No. 4 on the BWRVIP-26-A report is resolved with respect to the contents of the LRA.

AAI No. 4 on BWRVIP-27-A (BWRVIP I&FE Guidelines for SLC/Core ΔP Nozzles and Lines)

In the staff's SE on EPRI BWRVIP-27-A, dated December 20, 1999, the staff issued AAI No. 4, requesting that BWR applicants address those plant-specific TLAAs that may be applicable to the evaluation of BWR SLC/core ΔP nozzle components. Specifically, the staff stated that, due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27-A report for license renewal should identify and evaluate the projected fatigue CUFs as a potential TLAA issue.

In its response to this AAI, the applicant stated that cumulative fatigue damage is a potential TLAA issue identified for the SLC/core ΔP penetration nozzles (i.e., the RPV No. N-11 nozzles). The applicant stated that the TLAAs for cumulative fatigue damage of the SLC/core ΔP penetration nozzles are discussed in LRA Sections 4.3.1 and 4.3.3.

The staff verified that the applicant had provided and evaluated the metal fatigue analysis of the SLC/core ΔP penetration nozzles, including environmentally assisted fatigue (EAF), in LRA Sections 4.3.1 and 4.3.3. The staff also verified that the applicant provided and evaluated the metal fatigue analysis of the RPV internal portions of the SLC/core ΔP lines in LRA Section 4.3.4.

Based on this review, the staff finds that the applicant has adequately addressed AAI No. 4 on EPRI BWRVIP-27-A because the staff has verified that the applicant has included the applicable fatigue analyses for both the SLC/core ΔP penetration nozzles and those portions of SLC/core ΔP lines that are located internal to the RPVs in LRA Section 4.3. The staff's evaluation of the fatigue analysis for the SLC/core ΔP penetration nozzles is given in SER Section 4.3.1. The staff's evaluation of the EAF analysis for the SLC/core ΔP penetration nozzles is given in SER Section 4.3.3. The staff's evaluation of the fatigue analysis for the portions of SLC/core ΔP lines that are located internal to the RPVs is given in SER Section 4.3.4. AAI No. 4 on the BWRVIP-27-A report is resolved with respect to the contents of the LRA.

AAI No. 4 on BWRVIP-42-A (BWRVIP I&FE Guidelines for LPCI Couplings)

In the staff's SE on EPRI BWRVIP-42-A, dated January 9, 2001, the staff issued AAI No. 4, requesting that BWR applicants address those plant-specific TLAAs that may be applicable to the evaluation of BWR LPCI coupling components.

In its response to this AAI, the applicant stated that cumulative fatigue damage is a potential TLAA issue identified for the LPCI couplings. The applicant stated that the TLAA is used to manage cumulative fatigue damage for the LPCI coupling and that this TLAA is discussed in LRA Section 4.3.4.

The staff verified that the applicant provided the metal fatigue analysis of the LPCI couplings in LRA Section 4.3.4. The staff also verified that the CLB does not include any other type of analysis for the LPCI couplings that conforms to the definition of a TLAA in 10 CFR 54.3(a) or that would need to be identified as a TLAA in accordance with the requirement in 10 CFR 54.21(c)(1).

Based on this review, the staff finds that the applicant has adequately addressed AAI No. 4 on EPRI BWRVIP-42-A because the staff has verified that the applicant has included the applicable fatigue analysis for the LPCI couplings in LRA Section 4.3.4. The staff's evaluation of the metal fatigue TLAA for the LPCI couplings is given in SER Section 4.3.4. AAI No. 4 on the BWRVIP-42-A report is resolved with respect to the contents of the LRA.

AAI No. 4 on BWRVIP-47-A (BWRVIP I&FE Guidelines for BWR Lower Plenum Components)

In the staff's SE on EPRI BWRVIP-47-A, dated December 7, 2000, the staff issued AAI No. 4, requesting that BWR applicants address those plant-specific TLAAs that may be applicable to the evaluation of BWR lower plenum components. Specifically, in this AAI, the staff stated that, due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for license renewal should identify and evaluate the projected CUF as a potential TLAA issue.

In its response to this AAI, the applicant stated that fatigue usage is considered a TLAA for specific RVI lower plenum components that were analyzed in the design basis with a metal fatigue analysis. The applicant stated that the fatigue analyses for these components are addressed in LRA Section 4.3.4.

The staff verified that the CLB includes fatigue analyses for the RVI lower plenum components, which include the control rod drive housings and the access hole covers. The staff verified that the applicant identified that these analyses meet the definition of a TLAA in 10 CFR 54.3(a) and included the fatigue analyses as TLAAs for the components in LRA Section 4.3.4. The staff also verified that the CLB includes fatigue exemption analyses (i.e., fatigue waiver analyses) for the following RVI lower plenum components: (a) control rod guide tubes, (b) in-core instrumentation housings and guide tubes, and (c) fuel orifice supports.

The staff verified that the CLB does not include any other analyses for RVI lower plenum components that conform to the definition of a TLAA in 10 CFR 54.3(a) or that would need to be identified as a TLAA in accordance 10 CFR 54.21(c)(1).

Based on this review, the staff finds that the applicant has adequately addressed AAI No. 4 on EPRI BWRVIP-47-A because the staff has verified that the applicant has included and evaluated the applicable fatigue analyses or fatigue waiver analyses for these lower plenum components as TLAAs for LRA Section 4.3.4. The staff's evaluation of these TLAAs is given in SER Section 4.3.4. AAI No. 4 on the BWRVIP-47-A report is resolved with respect to the contents of the LRA.

AAI Nos. 8 through 13 on BWRVIP-74-A (BWRVIP I&FE Guidelines for BWR RPV Components)

In the staff's SE on EPRI BWRVIP-74-A, dated October 18, 2001, the staff issued AAI Nos. 8 through 13, which relate to the need for identification of the following TLAAs or assessments related to the RCPB function of BWR RPVs:

- AAI No. 8 on the need to identify metal fatigue TLAAs (CUF analyses) for RPV components that are part of the RCPB
- AAI No. 9 on the need to identify applicable pressure-temperature (P-T) limit TLAAs for the RPV

- AAI No. 10 on the need to identify applicable upper-shelf energy (USE) TLAAs for the RPV
- AAI Nos. 11 and 12 on the need to identify applicable mean reference temperature nil ductility transition (RT_{NDT}) and probability of failure TLAAs for RPV circumferential and axial weld components if the methodology in EPRI BWRVIP-05 was used to request relief from augmented inspection requirements for RPV circumferential welds in 10 CFR 50.55a(g) and if relief was granted in accordance with 10 CFR 50.55a(3) requirements for the current operating period
- AAI No. 13 on the need to perform 60-year neutron fluence value assessments for the RPV components as input to the TLAAs identified in AAI Nos. 9 through 12

The staff noted that the applicant included its response to these AAIs in LRA Appendix C. The staff also verified that the applicant has included all of these assessments as appropriate TLAAs for the LRA, as given in following LRA sections:

- LRA Section 4.3.1 for the metal fatigue TLAAs for RPV components
- LRA Sections 4.2.3 and 4.2.4 for the adjusted reference temperature (ART) and P-T TLAAs that are needed to ensure that appropriate P-T limits were be developed for the period of extended operation
- LRA Section 4.2.2 for the TLAA on USE
- LRA Sections 4.2.5 and 4.2.6 for the mean RT_{NDT} and conditional probability of failure analyses of the RPV axial and circumferential weld components
- LRA Section 4.2.1, which provides the 60-year neutron fluence evaluation and TLAA for components in the beltline and extended beltline of the RPV

Based on this review, the staff finds the applicant has addressed and resolved the requests in AAI Nos. 8 through 13 on the BWRVIP-74-A report because the applicant has included the applicable TLAAs in the LRA. The staff's evaluation of the neutron fluence TLAA for the RPV is given in SER Section 4.2.1. The staff's evaluation of the TLAA on RPV USE is given in SER Section 4.2.2. The staff's evaluation of the TLAA on the ART calculations for the RPV components is given in SER Section 4.2.3. The staff's evaluation of the TLAA for the P-T limits of the RPV is given in SER Section 4.2.4. The staff's evaluations of the TLAAs on the mean RT_{NDT} and conditional probability of failure analyses for the RPV axial and circumferential weld components are given in SER Sections 4.2.5 and 4.2.6. AAI Nos. 8 through 13 on the BWRVIP-74-A report are resolved.

AAI No. 6 on BWRVIP-76-A (BWRVIP I&FE Guidelines for BWR Core Shrouds)

In the staff's SE on EPRI BWRVIP-76-A, dated October 26, 2009, the staff issued AAI No. 6, requesting, in part, that BWR applicants address those TLAAs that may be applicable to the evaluation of their BWR core shroud components.

In regard to identifying applicable metal fatigue TLAAs for the core shrouds, the applicant responded to the AAI request and stated that the core shrouds (including shroud welds) are fabricated from either stainless steel or nickel alloy materials. The applicant stated that the CLB includes an evaluation of cumulative fatigue damage in the core shroud and that this evaluation (i.e., metal fatigue analysis) has been identified as a TLAA for the LRA. The applicant stated that the metal fatigue analysis for the core shrouds is assessed in LRA Section 4.3.4.

The staff verified that the CLB includes the following metal fatigue analyses for the core shrouds and associated components: (a) core shroud, (b) core shroud support, and (c) core shroud heads and steam separator assemblies. The staff verified that the applicant identified that these analyses meet the definition of a TLAA in 10 CFR 54.3(a) and included the fatigue analyses as TLAAs for the components in LRA Section 4.3.4.

Therefore, the staff finds that the applicant has adequately addressed AAI No. 4 on EPRI BWRVIP-76-A because the staff has verified that the applicant has included and evaluated the applicable fatigue analyses or fatigue waiver analyses for the core shrouds and associated components as TLAAs for LRA Section 4.3.4. The staff's evaluation of these TLAAs is given in SER Section 4.3.4. AAI No. 6 on the BWRVIP-76-A report is resolved with respect to the contents of the LRA.

4.1.2.2 Identification of Exemptions in the LRA

As required by 10 CFR 54.21(c)(2), the applicant must identify all exemptions that were granted in accordance with the exemption approval criteria in 10 CFR 50.12 and that are based on a TLAA. For those exemptions that meet these criteria, the rule requires the applicant to evaluate the exemptions and to justify their use during the period of extended operation.

In LRA Section 4.1.2, the applicant stated that it reviewed those exemptions that were granted in accordance with the requirements in 10 CFR 50.12 and that were currently in effect for the CLBs that apply to LSCS, Units 1 and 2. The applicant stated that none of the exemptions were associated with, or supported by, TLAAs. Therefore, the applicant stated that no further evaluation of these exemptions is required by the regulation in 10 CFR 54.21(c)(2).

The staff also reviewed the applicant's CLB to see whether the CLB included any exemptions that were granted in accordance with 10 CFR 50.12 and that were based on a TLAA. The staff's review included a review of the current operating licenses and TS for the facility and the applicant's UFSAR. The staff's review also included an "exemption" keyword search of the NRC's main and legacy libraries in the NRC's ADAMS Document Control Library. The staff reviewed the applicant's CLB to see if it contained any regulatory exemptions that were based on the methods of a TLAA and that might need to be identified for the LRA.

The staff noted that the operating licenses for LSCS, Units 1 and 2, identify that the applicant was granted specific exemptions from the requirements in Appendix G, "Fracture Toughness Requirements," to 10 CFR Part 50, which is the rule that applies to the performance of mandated time-dependent P-T limit calculations and a USE analysis. Similarly, the staff also noted that, in the operating licenses and at specific times during the current operating period, the applicant was granted specific exemptions from meeting the requirements for performing containment leak rate testing activities, as required in Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," to 10 CFR Part 50. However, the staff noted that neither the LRA nor the operating licenses specify what these exemptions involved. Therefore, the staff did not have sufficient information to make a determination on whether these exemptions (as granted under 10 CFR 50.12) were based on a TLAA.

The staff also noted that by letter dated February 29, 2000, the applicant requested exemptions to use the methods of analysis in American Society for Mechanical Engineers Boiler and Vessel Pressure Code (ASME Code) Cases N-640 and N-588 as bases for departing from the methodology requirements for calculating P-T limits, as specified in ASME Code Section XI,

Appendix G, and referenced in 10 CFR Part 50, Appendix G. The staff approved these exemptions in accordance with the requirements in 10 CFR 50.12 and in an SE, dated November 8, 2000.

The staff noted that the applicant had previously identified exemptions for use of ASME Code Cases N-640 and N-588 methodologies as exemptions that were previously granted in accordance with the requirements in 10 CFR 50.12 and that are based on a TLAA. Therefore, the staff noted that the exemption to use the ASME Code Cases N-640 and N-588 for the P-T limit calculations of LSCS, Units 1 and 2, might need to be included in the LRA and assessed under the requirements of 10 CFR 54.21(c)(2) if the exemption was still in effect and if it had not been formally withdrawn from the CLB for the units.

By letter dated July 7, 2015, the staff issued RAI 4.1-3, Parts 1 and 2, requesting that the applicant provide additional information regarding the bases for past exemptions that had been granted from specific requirements in 10 CFR Part 50, Appendix G or Appendix J. Specifically, in RAI 4.1-3, Part 1, the staff asked the applicant to identify all exemptions that were granted in accordance with the requirements of 10 CFR Part 50, Appendix G, and 10 CFR Part 50, Appendix J. For each exemption, the staff asked the applicant to describe the exemption and to clarify whether the exemption basis related to any methodologies for performing TLAA calculations or evaluations in the LRA. If so, the staff asked the applicant to justify why the specific exemption from the particular requirements in 10 CFR Part 50, Appendix G, or 10 CFR Part 50, Appendix J, would not need to be identified as an exemption that was granted in accordance with 10 CFR 50.12 and that is based on a TLAA, nor evaluated in accordance with the exemption evaluation requirements that are specified in 10 CFR 54.21(c)(2).

In RAI 4.1-3, Part 2, the staff asked the applicant to justify why the exemptions to use ASME Codes N-640 and N-588 had not been identified as exemptions meeting the criteria in 10 CFR 54.21(c)(2) when this had been done in another Exelon LRA that was pending staff approval.

The applicant responded to RAI 4.1-3, Parts 1 and 2, in a letter dated August 6, 2015. In its response to RAI 4.1-3, Part 1, the applicant stated that the exemptions listed in the operating licenses and requested in RAI 4.1-3, Part 1, involved the following topics:

- An exemption from the time required to perform 10 CFR Part 50, Appendix J Type A containment leak rate tests during the third inservice inspection and testing interval for the units. The applicant explained that this exemption was based only on the proposal of alternative scheduling criteria from those required by the rule and did not involve any time-dependent analysis.
- An exemption that requested alternative leak rate testing of main steam insolation valves based on alternative maximum pressure criteria and alternative leak rate acceptance criteria. The applicant explained that this exemption was based on use of specific alternative criteria and was not based on any time-dependent analysis.
- Exemptions for the requirements in Appendix G and Appendix H, “Reactor Vessel Material Surveillance Program Requirements,” to 10 CFR Part 50 that were needed because procurement of the reactor vessels for the facilities was based on ASME Code editions outside of those specified for use in 10 CFR 50.55a, “Codes and Standards.” The applicant explained that these exemptions were based only on the timing of the ASME Code editions and were not based on any time-dependent analysis.

The staff noted that the applicant's response to RAI 4.1-3, Part 1, adequately explained the nature of the exemptions that were included in the operating licenses for the LSCS units and provided adequate demonstration that the exemptions were only based on non-time-dependent criteria (such as alternative scheduling criteria or other non-time-dependent criteria, such as alternative pressure, leak rate, or ASME Code edition criteria) and were not based on any time-dependent analysis that would qualify as a TLAA. Therefore, based on this assessment, the staff concludes that the applicant adequately demonstrated that these exemptions do not conform to the criteria in 10 CFR 54.21(c)(2) because the applicant has adequately demonstrated that the exemptions were not based on a TLAA. RAI 4.1-3, Part 1, is resolved.

In its response to RAI 4.1-3, Part 2, the applicant addressed the exemptions to use methods of analysis in ASME Code Cases N-588 and N-640 for P-T limit calculations. The applicant stated that use of ASME Code Case N-588 is not relevant to the P-T limit evaluations of the RPVs at LSCS because neither of the RPVs is limited in the beltline region by a circumferential weld. Therefore, the applicant explained that, for P-T limit assessments, the Unit 1 RPV is limited by the ferritic weld material for an axial weld location and that the Unit 2 RPV is limited by the ferritic base metal material for an RPV lower intermediate shell plate location. Therefore, the applicant stated that, in the SE of November 8, 2000, the staff determined that the exemption to use ASME Code Case N-588 was not necessary for application to the CLB.

The applicant also clarified that, upon further review, the exemption to apply ASME Code Case N-640 as part of the basis for performing P-T limit calculations was applicable to the CLB. The applicant determined that the exemption to use ASME Code Case N-640 was based on a TLAA. Therefore, in the letter of August 6, 2015, the applicant amended the LRA to identify the exemption to use ASME Code Case N-640 as an exemption that (a) conformed to the criteria in 10 CFR 54.21(c)(2) and (b) was granted in accordance with 10 CFR 50.12 and is based on a TLAA. The applicant clarified that use of ASME Code Case N-640 will not be necessary for calculation of future P-T limits in the future because the methods of analysis in the ASME Code Case have been incorporated into editions of the ASME Code Section XI, Appendix G, that are incorporated by reference by 10 CFR 50.55a and that the applicant will be using the most recent ASME Code Section XI edition of record required by 10 CFR 50.55a as the basis for performing the P-T limit calculations in the future.

The staff finds that ASME Code Case N-588 is not applicable to the CLB because the staff has verified that the NRC did not add the ASME Code Case to the CLB in the SE of November 8, 2000. The staff also finds that the applicant has addressed the issue with use of ASME Code Case N-640 because the applicant has amended the application to identify the exemption for this ASME Code Case as an exemption that was granted in accordance with 10 CFR 54.21(c)(2) and that is based on a TLAA, and the applicant has provided an applicable analysis that provides adequate demonstration that ASME Code Case N-640 will not be used for the calculation of any updated P-T limits that may be necessary for the CLB in the future. RAI 4.1-3, Part 2, is resolved.

4.1.3 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has provided an acceptable list of TLAAs as defined in 10 CFR 54.3(a). The staff also concludes that the applicant has complied with the requirements in 10 CFR 54.21(c)(2) and has appropriately identified the exemption related to ASME Code Case N-640 as an exemption that was granted in accordance with 10 CFR 50.12 and that is based on a TLAA.

4.2 Reactor Vessel and Internals Neutron Embrittlement Analyses

LRA Section 4.2 provides the applicant's analyses of the following areas related to neutron fluence:

- LRA Section 4.2.1, Neutron Fluence Analyses
- LRA Section 4.2.2, Upper-Shelf Energy Analyses
- LRA Section 4.2.3, Adjusted Reference Temperature Analyses
- LRA Section 4.2.4, Pressure-Temperature Limits
- LRA Section 4.2.5, Axial Weld Failure Probability Assessment Analyses
- LRA Section 4.2.6, Circumferential Weld Failure Probability Assessment Analyses
- LRA Section 4.2.7, Reactor Pressure Vessel Reflood Thermal Shock Analyses
- LRA Section 4.2.8, RPV Core Plate Rim Hold-Down Bolt Loss of Preload Analysis
- LRA Section 4.2.9, Jet Pump Riser Brace Clamp Loss of Preload Analysis
- LRA Section 4.2.10, Jet Pump Slip Joint Repair Clamp Loss of Preload Analysis

4.2.1 Neutron Fluence Analyses

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 describes the applicant's TLAA for reactor vessel neutron fluence. The LRA states that the peak neutron fluences projected for 54 effective full-power years (EFPY) are 1.06×10^{18} n/cm^2 for LSCS, Unit 1, and 1.22×10^{18} n/cm^2 for LSCS, Unit 2, at the vessel inner surface. In addition, the one-quarter thickness (1/4T) peak fluence values (E > 1 MeV) for 54 EFPY are as follows for LSCS, Unit 1: 2.64×10^{17} n/cm^2 for lower shell assembly plates, 7.41×10^{17} n/cm^2 for the lower-intermediate shell assembly, 6.28×10^{17} n/cm^2 for the middle shell assembly, 2.30×10^{17} n/cm^2 for lower shell axial welds, 7.03×10^{17} n/cm^2 for lower-intermediate shell axial welds, 6.04×10^{17} n/cm^2 for middle shell axial welds, 6.28×10^{17} n/cm^2 for the lower intermediate-to-lower shell circumferential weld, and 2.64×10^{17} n/cm^2 for the middle-to-lower intermediate shell circumferential weld. The 1/4T peak fluence values (E > 1 MeV) for 54 EFPY are as follows for LSCS, Unit 2: 7.41×10^{17} n/cm^2 for lower shell assembly plates, 8.52×10^{17} n/cm^2 for the lower-intermediate shell assembly, 6.50×10^{17} n/cm^2 for lower shell axial welds, 8.02×10^{17} n/cm^2 for lower-intermediate shell axial welds, and 7.41×10^{17} n/cm^2 for the lower-to-lower-intermediate shell circumferential weld.

The reactor vessel neutron fluence values for LSCS, Units 1 and 2, for 60 years of operation (54 EFPY) are calculated using the RAMA methodology documented in EPRI BWRVIP-114NP-A, "RAMA Fluence Methodology Theory Manual," and its companion reports.[1] The RAMA methodology adheres to the guidance prescribed in the NRC's Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001. The neutron fluence calculation results are inputs into the other reactor vessel neutron embrittlement TLAAs, such as analyses for adjusted reference temperatures and P-T limits.

1 The companion reports are EPRI BWRVIP-115NP-A, "RAMA Fluence Methodology Benchmark Manual – Evaluation of Regulatory Guide 1.190 Benchmark Problems"; BWRVIP-117NP-A, "RAMA Fluence Methodology Plant Application – Susquehanna Unit 2 Surveillance Capsule Fluence Evaluation for Cycles 1-5"; and BWRVIP-121NP-A, "RAMA Fluence Methodology Procedures Manual."

The applicant dispositioned the TLAA for reactor vessel neutron fluence in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.1.2 Staff Evaluation

The staff evaluated the applicant's neutron fluence analysis for the reactor vessel, consistent with the review procedures in SRP-LR Section 4.2, which state that the applicant should (a) identify the neutron fluence for the reactor vessel at the end of the license renewal period, (b) identify the staff-approved methodology used to determine the neutron fluence or submit the methodology for staff review, and (c) determine whether the methodology follows the guidance in RG 1.190.

The staff noted that the NRC-approved 32-EFPY P-T limits for Unit 1 are based on the use of RAMA neutron fluence methodology. The staff also noted that the NRC-approved 32-EFPY P-T limits for Unit 2 are based on the use of the GEH method for neutron fluence calculation as described in the NRC-approved GE Licensing Topical Report NEDO-32983P-A, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 31, 2006. The staff further noted that the fluence calculation uncertainty analysis and qualification of these methodologies adhere to the guidance contained in RG 1.190. Specifically, the staff's acceptance of the RAMA methodology is described in the SE, dated May 13, 2005, for the BWRVIP-114NP-A report, and the GEH methodology is described in the SE, dated November 17, 2005, for NEDO-32982P-A.

In its review, the staff noted that LRA Section 4.2.1 does not clearly discuss the current use of the RAMA and GEH methodologies for 40 years of operation. Therefore, the staff found a need to confirm whether these two methodologies are also used to calculate the 60-year reactor vessel neutron fluence of LSCS, Units 1 and 2.

By letter dated August 18, 2015, the staff issued RAI 4.2.1-1, Part 1, requesting that the applicant clarify whether the 54-EFPY neutron fluences described in the LRA are based on the GEH methodology, the RAMA methodology, or a combination of the two methodologies.

In the applicant's response dated September 15, 2015, the applicant confirmed that the 54-EFPY neutron fluence projections for LSCS, Units 1 and 2, described in LRA Section 4.2 to account for reactor vessel exposure from 0 to 54 EFPY are based on the NRC-approved RAMA fluence methodology. The applicant also revised LRA Section 4.2.1 to further clarify the methodologies that were used to calculate the 40-year and 60-year neutron fluence values for Units 1 and 2.

Based on its review, the staff finds the applicant's response acceptable based on the applicant confirming that the 60-year reactor vessel neutron fluence values are calculated using the NRC-approved RAMA methodology and revising LRA Section 4.2.1 adequately to provide additional background information and clarification regarding the methodology for the 60-year reactor vessel neutron fluence calculations. Part 1 of RAI 4.2.1-1 is resolved. Part 2 of RAI 4.2.1-1 is discussed in SER Section 4.2.4.2.

Based on its review, the staff determined that the applicant adequately addressed the TLAA on the reactor vessel neutron fluence for the period of extended operation because the fluence evaluation was performed in accordance with NRC-approved, RG 1.190-adherent methodology, and the applicant provided 54-EFPY fluence values to cover the period of extended operation.

4.2.1.3 UFSAR Supplement

LRA Section A.4.2.1 provides the UFSAR supplement summarizing the TLAA on the reactor vessel neutron fluence. The staff reviewed LRA Section A.4.2.1, consistent with the review procedures in SRP-LR Section 4.2, which state that the applicant should provide a summary description of the evaluation of the reactor vessel neutron embrittlement. Based on the staff's review of the UFSAR supplement, the staff determined that the applicant provided an adequate summary description of the actions to address the neutron fluence analysis, as required by 10 CFR 54.21(d).

4.2.1.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the neutron fluence analysis for the reactor vessel 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).

4.2.2 Upper-Shelf Energy Analyses

The NRC's requirements for performing USE analyses of ferritic materials (i.e., steel plate or forging components) and ferritic welds in the beltline region of the RPV are specified in 10 CFR Part 50, Appendix G. The rule requires the USE values for these RPV components to be greater than or equal to 50 ft-lb at the end of the licensed operating period. These analyses are TLAAs because the analyses meet all six of the criteria in 10 CFR 54.3(a) that define an analysis as a TLAA.

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2, as revised by letter dated September 28, 2015, describes the applicant's TLAA evaluation for the calculation of the USE of the LSCS, Units 1 and 2, RPV beltline materials. The LRA states that USE values for the Unit 1 and Unit 2 RPV beltline materials have been updated based on 54 EFPY for 60 years of plant operation using the neutron fluence values at 1/4T for each location. The LRA also states that the methods used to calculate the fluence values at 1/4T for 54 EFPY and to project the USE values are consistent with RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," dated May 1988. The fluence values at 1/4T are determined using the dpa method which replaces the exponential attenuation factor in Equation 3 of RG 1.99, Revision 2. The LRA further states that the N12 water level instrument nozzles and N6 LPCI nozzles are within the RPV beltline. The LRA clarifies that the N12 nozzles and welds are nickel alloy 600 and, therefore, do not require evaluation. The plates surrounding the N12 nozzles are ferritic and are evaluated at the 1/4T location along the limiting pressure stress cross-section extraction path, which is shown in LRA Figure 4.2.2-1. The N6 LPCI nozzles and welds are ferritic materials and are also evaluated at the 1/4T location along the limiting pressure stress cross-section extraction path as shown in LRA Figure 4.2.2-2. LRA Table 4.2.2-1 and Table 4.2.2-2, for Unit 1 and Unit 2, respectively, provide the USE values calculated for 54 EFPY for each location evaluated, as well as the unirradiated values and associated copper content percentages.

The applicant dispositioned the TLAA for the calculation of the USE for the ferritic RPV beltline materials in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analyses have been projected to the end of the period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the calculation of the USE for the ferritic RPV beltline materials and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.2.3.1.1.2. These procedures state that the staff is to review the documented results of the applicant's updated USE analysis based on the projected neutron fluence at the end of the period of extended operation for compliance with 10 CFR Part 50, Appendix G. The regulations in 10 CFR Part 50, Appendix G, require that the USE values of the ferritic RPV components be greater than or equal to 50 ft-lb at the end of the licensed operating period. These procedures also state that the applicant may use RG 1.99, Revision 2, to project the USE to the end of the period of extended operation.

The staff reviewed Revision 20 to UFSAR Section 5.2.3.3.1, "Fracture Toughness," to verify that the initial unirradiated Charpy USE values and copper content percentages provided in LRA Table 4.2.2-1 and Table 4.2.2-2 are consistent with the CLB for LSCS, Units 1 and 2, respectively. UFSAR Section 5.2.3.3.1.2.2, "Alternative Compliance with 10 CFR 50 Appendix G," provides two references by GE Nuclear Energy, dated May 2004, that describe the methodologies used to comply with 10 CFR Part 50, Appendix G, and the associated staff evaluation, dated April 15, 2011, finding these methods acceptable. The staff verified that the unirradiated USE values and copper content percentages provided in LRA Table 4.2.2-1 and Table 4.2.2-2 are consistent with the CLB, with the exception of the N6 LPCI nozzle welds. The relevant information for the N6 LPCI nozzle welds was not included in the references reviewed by the staff.

By letter dated August, 28, 2015, the staff issued RAI 4.2.2-1, requesting that the applicant provide information associated with the USE and ART analyses. Aspects of RAI 4.2.2-1 associated with the ART analysis are reviewed in SER Section 4.2.3. Part 1 of RAI 4.2.2-1 requested that the applicant provide either (a) documentation that confirms that the N6 LPCI nozzle weld unirradiated USE values and copper content percentages in LRA Table 4.2.2-1 and Table 4.2.2-2 are part of the CLB and have been reviewed and accepted by the staff, or (b) the source and technical substantiation of the values if the N6 LPCI nozzle welds were added to the evaluation for license renewal.

In its response dated September 28, 2015, the applicant revised LRA Tables 4.2.2-2 and 4.2.2-3 to correct administrative entries that are unrelated to the copper contents, unirradiated USE values, or fluence values. The response stated that the percent copper values for the LSCS, Units 1 and 2, N6 LPCI nozzle welds are obtained from the certified material test reports (CMTRs) for the specific material heats, except the EAIB weld heat for Unit 1. The CMTR for the Unit 1 EAIB weld heat did not contain the percent copper value. The applicant also stated that the percent copper for the EAIB weld was determined using data from the BWR fleet database and the NRC Reactor Vessel Information Database for shielded metal-arc welding (SMAW) materials. The databases contained 86 unique data points that were evaluated using a mean+2σ statistical methodology to determine the percent copper content. The applicant further stated that the percent copper values for the Unit 1 N6 LPCI nozzle welds has been previously reviewed and approved by the NRC. Additionally, the applicant stated that the unirradiated USE values for the N6 LPCI nozzle welds provided in LRA Tables 4.2.2-1 and 4.2.2-2 are generic values for low-alloy steel SMAW material.

The staff reviewed the applicant's response and finds it acceptable because the percent copper values for the N6 LPCI nozzle weld material were provided in the applicant's license amendment request to revise the P-T curves for LSCS, Unit 1, which was approved by the NRC in the safety evaluation dated November 25, 2014. In this safety evaluation, the staff noted that the copper content for the EAIB weld heat is conservatively estimated. The unirradiated USE value used for the N6 LPCI nozzle weld material is 72.8 ft-lb. The staff noted that Section B.3.1 of EPRI BWRVIP-74-A, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal," provides a generic RPV USE analysis and equivalent margins analysis (EMA) that may be applied by applicants owning BWR units. The staff noted that the generic methodology in the BWRVIP-74-A report is based on a limiting statistical analysis of unirradiated USE data for BWR ferritic materials and was approved by an NRC letter dated September 16, 2003. The staff noted that the statistical analysis established a lower bounding unirradiated USE value of 84.5 ft-lb for SMAW welds.

In summary, the percent copper values for the Unit 1 and Unit 2 N6 LPCI nozzle welds has been previously reviewed and approved by the NRC in a safety evaluation dated November 25, 2014. The percent copper values for the Unit 1 and Unit 2 N6 LPCI nozzle welds were obtained from the CMTRs for the specific material heats, except the EAIB weld heat for Unit 1. The unirradiated USE values for the Unit 1 and Unit 2 N6 LPCI nozzle welds are generic values for low alloy steel SMAW material which the staff has determined to be conservative based on the lower bounding unirradiated USE value in BWRVIP-74-A. The staff's concerns, associated with the USE evaluation, described in Part 1 of RAI 4.2.2 1, are resolved.

The fluence values that are used to project the USE values to the end of the period of extended operation (54 EFPY) are provided in LRA Tables 4.2.1-2 through 4.2.1-6. The LRA states that the methods used to calculate the fluence values at 1/4T for 54 EFPY are consistent with RG 1.99, Revision 2. The staff's evaluation of the neutron fluence analyses is in SER Section 4.2.1.

The staff noted that the guidance in RG 1.99, Revision 2, provides two methods for projecting USE values to the end of the licensed operating period. Regulatory Position 1.2 in RG 1.99, Revision 2, projects the USE values at the end of the licensed operating period using a graphical relationship from Figure 1 of the RG to determine the percent decrease in USE as a function of copper content and fluence. Regulatory Position 2.2 in RG 1.99, Revision 2, projects the USE values at the end of the licensed operating period using plant surveillance data to adjust the graphical relationship in Regulatory Position 1.2. The LRA states that the USE values were projected to 54 EFPY based on methods consistent with RG 1.99, Revision 2. The staff noted that the USE values projected to 54 EFPY are provided in LRA Table 4.2.2-1 and Table 4.2.2-2; however, it is unclear to the staff if RPV surveillance data were applied to the USE value projections. To address this issue, Part 2 of RAI 4.2.2-1 requested that the applicant clarify if it used surveillance data to calculate any of the projected USE values and to distinguish between USE values that were calculated using Regulatory Position 1.2 and Regulatory Position 2.2. Part 3 of RAI 4.2.2-1 requested that the applicant identify any surveillance data reports associated with capsule withdrawals and test results obtained from the Integrated Surveillance Program (ISP) that are applicable to either LSCS, Units 1 or 2.

In its response dated September 28, 2015, the applicant stated that Regulatory Position 1.2 was used to identify the limiting USE values for both LSCS, Units 1 and 2. The applicant stated that Unit 1 has credible surveillance data for representative plate and weld material that meet the criteria of RG 1.99, Revision 2. The USE values for the representative plate (heat C6345-1) and weld material (heat 1P3571) are provided in LRA Table 4.2.2-1, as revised by letter dated September 28, 2015, under the heading, "Unit 1 Integrated Surveillance Program Chemistry Values from BWRVIP-135 Revision 3." The applicant stated that these integrated surveillance program (ISP) USE values were the only values determined using Regulatory Position 2.2 for

Unit 1, although the USE values for RPV beltline components determined using Regulatory Position 1.2 (i.e., that are not represented by ISP surveillance data) for the corresponding heats, are more limiting.

The applicant stated that LSCS, Unit 2, does not have credible surveillance data for representative plate and weld material that meet the criteria of RG 1.99, Revision 2. The USE values determined using surveillance data are provided in LRA Table 4.2.2-2, as revised by letter dated September 28, 2015, under the heading, "Unit 2 Integrated Surveillance Program Chemistry Values from BWRVIP-135 Revision 3." The applicant stated that these ISP USE values for plate (heat C3054-2) and weld material (heat 402K9171, 411L3071) were the only values determined using Regulatory Position 2.2 for Unit 2. The applicant further stated that these values are provided for reference only.

The applicant stated that it previously submitted the following technical summary reports to the NRC in accordance with Section IV, "Report of Test Results," of Appendix H to 10 CFR Part 50:

- EPRI Letter 2011-206, "Project No. 704 – BWRVIP-250NP: BWR Vessel and Internals Project, Testing and Evaluation of the LaSalle Unit 1 120° Surveillance Capsule"
- EPRI Letter 2013-188, "Project No. 704 – BWRVIP-275NP: BWR Vessel and Internals Project, Testing and Evaluation of the Susquehanna Unit 1 120° Surveillance Capsule"

The staff reviewed the applicant's response and finds it acceptable because the applicant clarified the use of Regulatory Position 1.2 and Regulatory Position 2.2. Regulatory Position 1.2 was used to determine the limiting 60-year USE values for both LSCS, Units 1 and 2. The limiting 60-year USE values for Unit 1 are 68 ft-lb for forgings (heat Q2Q22W) and 62 ft-lb for weld material (heat 1P3571). The limiting 60-year USE values for Unit 2 are 53 ft-lb for plate (heat C9434–2) and 55 ft-lb for weld material (heat 5P6771). The applicant also provided the technical summary reports associated with capsule withdrawals and test results obtained from the ISP that are applicable to either Unit 1 or Unit 2. The staff verified that ISP material heats referenced for each Unit are consistent with the surveillance capsules identified in BWRVIP-86, Revision 1, "Updated BWR Integrated Surveillance Program (ISP) Implementation Plan," which has been approved by the staff. The staff's concerns, associated with the USE evaluation, described in Part 2 of RAI 4.2.2-1 are resolved. The staff's concerns described in Part 3 of RAI 4.2.2-1 are also resolved.

Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analyses for the ferritic materials and ferritic welds in the beltline region of the RPV have been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.2.1.1 because the USE values of the LSCS, Units 1 and 2, ferritic RPV beltline materials comply with the requirements in 10 CFR Part 50, Appendix G. Specifically, the USE values that have been projected to the end of the extended operating period all exceed 50 ft-lbs.

4.2.2.3 UFSAR Supplement

LRA Section A.4.2.2 provides the UFSAR supplement summarizing the USE analyses for the ferritic materials and ferritic welds in the beltline region of the RPV. The staff reviewed LRA Section A.4.2.2 consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer must verify that the applicant has provided a supplement with information that is equivalent to the examples in SRP-LR Table 4.2-1.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.2.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the USE analyses for the ferritic materials and ferritic welds in the beltline region of the RPV, as required by 10 CFR 54.21(d).

4.2.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analyses for the ferritic materials and ferritic welds in the beltline region of the RPV have 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).

4.2.3 Adjusted Reference Temperature Analyses

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3, as revised by letter dated September 28, 2015, describes the applicant's TLAA evaluation of the ARTs for the ferritic reactor vessel beltline materials (plates, forgings, and welds). The LRA states that ART values for LSCS, Units 1 and 2, RPV beltline materials have been updated based on 54 EFPY for 60 years of plant operation using the neutron fluence values at 1/4T for each location. The LRA also states that the methods used to calculate the fluence values at 1/4T for 54 EFPY and to project the ART values are consistent with RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials." The ferritic material within the beltline include the shell plates, axial welds, circumferential welds, N6 LPCI nozzle forgings, and N6 LPCI welds. The LRA states that the N12 water level instrument nozzles and welds are nickel alloy, although the 1/4T location along the limiting pressure stress cross-section is located within the surrounding ferritic plate, as shown in LRA Figure 4.2.2-1. The LRA further states that the ART values for the N12 water level instrument nozzles and welds were determined using the values for the surrounding ferritic plate material.

LRA Table 4.2.3-1 and Table 4.2.3-2 provide the 54-EFPY ART values and associated information for each location evaluated for LSCS, Unit 1. The Unit 1 RPV was fabricated by CE, and the beltline region is illustrated in LRA Figure 4.2.1-1. LRA Table 4.2.3-3 and Table 4.2.3-4 provide the 54-EFPY ART values and associated information for each location evaluated for Unit 2. The Unit 2 RPV was fabricated by CB&I, and the beltline region is illustrated in LRA Figure 4.2.1-2.

The applicant dispositioned the TLAA for the ferritic RPV beltline materials in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the ART values have been projected to the end of the period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the ferritic RPV beltline materials and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2. These procedures state that the staff is to review the results of the applicant's revised analysis to verify that the evaluation period has been extended such that the analysis is valid for the period of extended operation. SRP-LR Section 4.7.3.1.2 also states that the applicant may recalculate the analysis using a 60-year period to show that the acceptance criteria continue to be satisfied for the period of extended operation.

The staff reviewed Revision 20 to UFSAR Section 5.2.3.3.1, “Fracture Toughness,” and Section 5.2.3.3.1.2.2, “Alternative Compliance with 10 CFR 50 Appendix G,” and the applicable reference documents to verify that the initial unirradiated RT_{NDT} values, copper content percentages, and nickel content percentages provided in LRA Section 4.2.3-1, Table 4.2.3-2, Table 4.2.3-3, and Table 4.2.3-4 are consistent with the CLB. The specific reference documents reviewed are described in SER Section 4.2.2.2. The staff verified that the initial RT_{NDT} values and composition percentages provided in these LRA Section 4.2.3 tables are consistent with the CLB, with the exception of the N6 LPCI nozzle welds.

By letter dated August 28, 2015, the staff issued RAI 4.2.2-1, requesting that the applicant provide information associated with the USE and ART analyses. Aspects of RAI 4.2.2-1 associated with the USE analysis are reviewed in SER Section 4.2.2. Part 1 of RAI 4.2.2-1 requested that the applicant provide either (a) documentation that confirms the N6 LPCI nozzle weld initial RT_{NDT} values and composition percentages in LRA Table 4.2.3-2 and Table 4.2.3-4 are part of the CLB and have been reviewed and accepted by the staff, or (b) the source and technical substantiation of the values if the N6 LPCI nozzle welds were added to the evaluation for license renewal.

In its response dated September 28, 2015, the applicant stated that the percent nickel values for LSCS, Units 1 and 2, N6 LPCI nozzle welds are obtained from the CMTRs for the specific material heats. The applicant responded similarly for the percent copper values, as described in SER Section 4.2.2. The applicant also stated that the initial RT_{NDT} values for Units 1 and 2 were determined using the GE/Boiling Water Reactor Owners Group (BWROG) methodology defined in NEDC-32399-P, “Basis for GE RT_{NDT} Estimation Method,” dated September 1994. The applicant further stated that the information associated with the Unit 1 N6 LPCI nozzle welds is part of the CLB.

The staff reviewed the applicant’s response and finds it acceptable because the initial RT_{NDT} values and composition percentages for the N6 LPCI nozzle weld material were provided in the applicant’s license amendment request to revise the P-T curves for LSCS, Unit 1, and were approved in an NRC safety evaluation dated November 25, 2014. The RT_{NDT} values and composition percentages for Unit 2 were determined in the same manner as those for Unit 1. The percent copper and nickel values for Unit 2 were obtained from the CMTRs for the specific material heats. The initial RT_{NDT} values for the Unit 2 N6 LPCI nozzle welds were determined using the GE/BWROG methodology defined in GE Nuclear Energy report NEDC-32399-P, dated September 1994, which was approved in an NRC SE, dated December 16, 1994. The staff’s concerns, associated with the ART evaluation, described in Part 1 of RAI 4.2.2-1 are resolved.

The fluence values that are used to project the ART values to the end of the licensed operating period (54 EFPY) are provided in LRA Section 4.2.1. The LRA states that the methods used to calculate the fluence values at 1/4T for 54 EFPY are consistent with RG 1.99, Revision 2. The staff’s evaluation of neutron fluence analyses is in SER Section 4.2.1.

The guidance in RG 1.99, Revision 2, provides two methods for projecting ART values to the end of the licensed operating period. Regulatory Position 1.1 in RG 1.99, Revision 2, projects the ART values at the end of the licensed operating period using the initial RT_{NDT}, material composition, and fluence when there is no credible surveillance data available. Regulatory

Position 2.1 in RG 1.99, Revision 2, projects the ART values at the end of the licensed operating period using surveillance data when there are two or more credible data sets available. The LRA states that the ART values were projected to 54 EFPY based on methods consistent with RG 1.99, Revision 2; however, it is unclear to the staff if surveillance data are used in these projections. To address this issue, Part 2 of RAI 4.2.2-1 requested that the applicant clarify if it used surveillance data to calculate any of the projected ART values and to distinguish between ART values that were calculated using Regulatory Position 1.1 and Regulatory Position 2.1. Part 3 of RAI 4.2.2-1 is associated with the reporting of surveillance program data and is reviewed in SER Section 4.2.2.2.

In its response dated September 28, 2015, the applicant stated that credible surveillance data are available for LSCS, Unit 1, but not for Unit 2. The applicant stated that Regulatory Position 2.1 was used to calculate the ART values for the plate (heat C6345-1) and weld (heat 1P3571) materials provided in LRA Table 4.2.3-2 under the heading, "Unit 1 Integrated Surveillance Program Chemistry Values from BWRVIP-135 Revision 3." All other ART values for the Unit 1 RPV in LRA Table 4.2.3-1 and Table 4.2.3-2 are determined using Regulatory Position 1.1. The applicant also stated that the ART values determined using Regulatory Position 2.1 are greater than those determined using Regulatory Position 1.1. The applicant further stated that the highest ART values are limiting; therefore, the values determined using Regulatory Position 2.1 are limiting for heats C6345-1 and 1P3571.

For Unit 2, the applicant stated that Regulatory Position 2.1 was used to calculate ART values for the plate and weld materials provided in LRA Table 4.2.3-4 under the heading, "Unit 2 Integrated Surveillance Program Chemistry Values from BWRVIP-135 Revision 3." The applicant also stated these heats of material do not meet the criteria in RG 1.99, Revision 2, for verifying the credibility of RPV surveillance data and that the information is provided for reference only. The applicant indicated that all other ART values for the LSCS, Unit 2, RPV in LRA Table 4.2.3-3 and Table 4.2.3-4 are determined using Regulatory Position 1.1.

The staff reviewed the applicant's response and finds it acceptable because the applicant clarified the use of Regulatory Position 1.2 and Regulatory Position 2.2. The limiting 60-year ART values for LSCS, Unit 1, are 59 °F for the limiting RPV plate component (heat B0078-1) and 139 °F for the limiting RPV weld component (heat 1P3571). The limiting ART values for Unit 1 were determined using Regulatory Position 1.1 for the plate material and Regulatory Position 2.1 for the weld material. The limiting 60-year ART values for Unit 2 are 90 °F for the limiting RPV plate component (heat C9425-1) and 25 °F for the limiting RPV weld component (heat 3P4966). The limiting ART values for Unit 2 were determined using Regulatory Position 1.1 for both the plate and weld material. The staff's concerns, associated with the ART evaluation, described in Part 2 of RAI 4.2.2-1 are resolved.

Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the ART analysis for the ferritic RPV materials has been projected to the end of the period of extended operation. Additionally, the ART analysis meets the acceptance criteria in SRP-LR Section 4.7.3.1.2 because the applicant's analysis adequately evaluates the effects of neutron irradiation embrittlement, including the surveillance data, in accordance with RG 1.99, Revision 2.

4.2.3.3 UFSAR Supplement

LRA Section A.4.2.3 provides the UFSAR supplement summarizing the ART analysis for the ferritic RPV materials. The staff reviewed LRA Section A.4.2.3 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer must verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the UFAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address ART analysis for the ferritic RPV materials, as required by 10 CFR 54.21(d).

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the ART analysis for the ferritic RPV beltline components 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).

4.2.4 Pressure-Temperature Limits

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 describes the applicant's TLAA for pressure-temperature (P-T) limits. The technical information that the applicant provided in the LRA is summarized in this section.

The regulations in 10 CFR Part 50, Appendix G, require that the reactor vessel be maintained within established P-T limits. These limits specify the minimum acceptable reactor coolant temperature as a function of reactor pressure. As the reactor vessel is exposed to increased neutron irradiation over time, the P-T limits must account for the reduction in fracture toughness due to anticipated reactor vessel fluence. The current P-T limit curves are located in the TS and are based the cumulative neutron fluence levels for the reactor vessels through 32 EFPY of licensed operations. Because the P-T limits for 32 EFPY are based on the nominal amount of power assumed for 40 years of plant operation, the P-T limits satisfy the criteria of 10 CFR 54.3(a) and have been identified as a TLAA.

The LRA states that the P-T limits are currently located in the TS, but a pressure-temperature limit report (PTLR) may be submitted for NRC approval for the next P-T limit update, which must occur before 32 EFPY. Updated P-T limits will be approved for use before 32 EFPY for each unit. Maintenance of the P-T limits during the period of extended operation will be managed through the licensing process in 10 CFR 50.90, "Application for Amendment of License, Construction Permit, and Early Site Permit," as currently required by TS or by the PTLR process and the plant's administrative controls section of the TS if a PTLR has been approved at that time.

The applicant dispositioned this TLAA on the P-T limits for the reactor vessels in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the reactor vessels will be adequately managed.

4.2.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor vessels and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.2.3.1.3.3. The review procedures indicate that (1) updated P-T limits for the period of extended operation must be available before the period of extended operation, and (2) an adequate process to maintain and update the P-T limits through the period of extended operation is the 10 CFR 50.90 process for P-T limits located in the limiting conditions of operation (LCO) of the plant TS, or an administrative process for updating P-T limits located in a PTLR, as controlled by the administrative controls section of the plant TS.

SRP-LR Section 4.2.3.1.3.3 also states that, for BWRs, the staff confirms that the applicant addresses license renewal AAI No. 9 that is specified in the staff's SE for the BWRVIP-74 report. The action item is that the applicant, who has not provided updated P-T limits for the period of extended operation, shall have a process for updating P-T limits before the period of extended operation in accordance with 10 CFR Part 50, Appendix G, to cover updates to the P-T limits during the period of extended operation.

The staff reviewed the applicant's CLB to determine whether the applicant updates its P-T limits through updates of the LCOs in the plant TS in accordance with the 10 CFR 50.90 license amendment process or through a PTLR process that is governed and controlled by the administrative controls section of the plant TS.

In its review, the staff noted that, by its letter dated April 15, 2011, the NRC approved the 32-EFPY P-T limits for LSCS, Units 1 and 2, through the 10 CFR 50.90 license amendment process. The staff also noted that the applicant's P-T limits were generated by using the staff-approved methodology described in Licensing Topical Report NEDC-33178P-A, "Licensing Topical Report GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure Temperature Curves," dated June 2009. The staff further noted that, by its letter dated November 25, 2014, the NRC approved a revision to the 32-EFPY Unit 1 P-T limits through the license amendment process. That revision was based on credible Unit 1 reactor vessel surveillance data from the 120-degree capsule (weld material 1P3571) and the associated change to the ART for the beltline material. As discussed above, the staff confirmed that the updates of the LSCS P-T limits were controlled in accordance with the 10 CFR 50.90 license amendment process, consistent with SRP-LR Section 4.2.3.1.3.3.

The applicant also indicated that PTLRs may be submitted for NRC approval for the next P-T limit update and that the PTLR process will be used to update P-T limits if a PTLR has been approved by the staff. The applicant further indicated that the 10 CFR 50.90 process or the PTLR process, whichever constitutes the CLB as approved by the NRC, will ensure that the P-T limits for the period of extended operation will be updated before expiration of the 32-EFPY P-T limits. The staff noted that these processes that the applicant identified for updates to the P-T limits are consistent with those specified in SRP-LR Section 4.2.3.1.3.3.

In its review, the staff noted the following concern related to the P-T limits and neutron fluence projections. LRA Section 4.2.1 describes the applicant's TLAA on reactor vessel fluence calculations for the period of extended operation. However, it was not clear to the staff how the applicant will ensure that the actual fluence levels are bounded by the projected fluence levels without impact on the validity of neutron embrittlement analyses (such as P-T limits analysis) throughout the period of extended operation.

By letter dated August 18, 2015, the staff issued RAI 4.2.1-1, regarding reactor vessel neutron fluence projections. In Part 2 of the RAI, the staff addressed the concern described above and requested that the applicant clarify how it will ensure that the actual fluence levels are bounded by the neutron fluence levels analyzed in LRA Section 4.2.1. Part 1 of the RAI is discussed in SER Section 4.2.1.2.

In its letter dated September 15, 2015, the applicant stated that, to ensure that the LSCS, Units 1 and 2, actual fluence levels are bounded through the period of extended operation, the fluence values projected in LRA Section 4.2.1 are based on conservative estimates of future unit operating capacity factor and previously withdrawn and tested flux wires and capsule dosimetry. The applicant also stated that the EFPY and cumulative fluence are tracked to ensure that analyzed conditions are not exceeded. The applicant further indicated that, before each scheduled reactor refueling outage, actual and estimated EFPY are determined and reconciled against the CLB.

In addition, the applicant stated that, before exceeding the EFPY value qualified in the current P-T limits, fluence projections will be updated and revised P-T limits will be calculated and incorporated into the CLB. The applicant stated that LSCS, Unit 1, is a BWRVIP ISP host plant. The applicant also stated that, as a BWRVIP ISP host plant, one remaining surveillance capsule will be withdrawn per the BWRVIP ISP withdrawal schedule, which will provide future dosimetry data for use as an additional benchmark for the LSCS, Unit 1, fluence projections.

In its review, the staff finds the applicant's response acceptable because the applicant clarified that (1) cumulative fluence values are tracked to ensure that the actual operating conditions do not exceed the analyzed fluence levels, (2) actual and estimated EFPY are determined and evaluated at the end of each fuel cycle to ensure that the operating conditions are consistent with the CLB, and (3) future dosimetry data from the Reactor Vessel Surveillance program will be used for additional benchmarking of the LSCS, Unit 1, fluence projections. The staff's concern described in RAI 4.2.1-1, Part 2, is resolved.

As discussed above, the staff noted that the P-T limits of LSCS, Units 1 and 2, are currently located in the LCO of the TS. The staff also noted that the applicant may submit a license amendment request in accordance with Generic Letter (GL) 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protection System Limits," dated January 1, 1996, for implementing the PTLR process to relocate the P-T limits into a PTLR. If the applicant's PTLR is approved in the 10 CFR 50.90 license amendment process, the applicant may use the PTLR process to update P-T limits in accordance with the administrative controls section of the TS during the period of extended operation.

Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the reactor vessels will be adequately managed in accordance with the 10 CFR 50.90 license amendment process before entering into the period of extended operation. The applicant may use the PTLR process to update P-T limits if the relocation of P-T limits into PTLRs is approved. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.2.1.3.3 because these processes that the applicant identified for the updates to P-T limits provide an adequate basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.4.3 UFSAR Supplement

LRA Section A.4.2.4 provides the UFSAR supplement summarizing the TLAA on the P-T limits of reactor vessels. The staff reviewed LRA Section A.4.2.4, consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the reactor vessel neutron embrittlement TLAA. Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.3.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for the P-T limits of reactor vessels, as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the P-T limits will be adequately managed for the period of extended operation through the 10 CFR 50.90 license amendment process. 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).

4.2.5 Axial Weld Failure Probability Assessment Analyses

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 describes the evaluation of the reactor vessel axial weld failure probability analysis based on 54-EFPY mean RT_{NDT} for the period of extended operation. The technical information in the LRA is summarized as follows in this section.

The BWRVIP recommendations for inspection of reactor vessel shell welds in the BWRVIP-05 report include examination of 100 percent of the axial welds and inspection of the circumferential welds only at the intersections of these welds with the axial welds. The BWRVIP-05 report contains generic analyses supporting a generic conclusion in the NRC SE, dated July 28, 1998, of the BWRVIP-05 report that the 40-year axial weld failure probability is orders of magnitude greater than the circumferential weld failure probability. This weld failure probability analysis was used to justify relief from inspection of the circumferential welds, as permitted in GL 98-05, "Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds," dated November 10, 1998, and as described in LRA Section 4.2.6.

In addition, the NRC SE, dated July 28, 1998, of the BWRVIP-05 report provides conditional failure probability values for the axial welds of the Combustion Engineering Owners Group (CEOG) reactor vessel and CB&I reactor vessel at 64 EFPY. Although a conditional failure probability has not been calculated for the LSCS units at 54 EFPY, the Unit 1 mean RT_{NDT} of 139.9 °F is less than the NRC-assessed value of 172.4 °F at 64 EFPY for the CEOG reactor vessel, and the Unit 2 mean RT_{NDT} of 12 °F is less than the NRC-assessed value of 117.1 °F at 64 EFPY for the CB&I reactor vessel. Based on this, the LRA concludes that the conditional failure probabilities and RT_{NDT} values of Units 1 and 2 axial welds are bounded by the NRC analysis, consistent with the requirements defined in GL 98-05.

The applicant initially dispositioned the TLAA for the reactor vessel axial welds of LSCS, Units 1 and 2, in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.5.2 Staff Evaluation

The staff reviewed the TLAA associated with the reactor vessel axial welds and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.2.3.1.5, which state the following:

> To demonstrate that the vessel has not been embrittled beyond the basis for the staff and BWRVIP analyses, the applicant should provide (a) a comparison of the neutron fluence, initial RT_{NDT}, chemistry factor, amounts of copper and nickel, ΔRT_{NDT}, and mean RT_{NDT} of the limiting axial weld at the end of the license renewal period to the reference case in the BWRVIP and staff analyses and (b) an estimate of conditional failure probability of the RPV at the end of the license renewal term based on the comparison of the mean RT_{NDT} for the limiting axial welds and the reference case. If this comparison does not indicate that the RPV failure frequency for axial welds is less than $5x10^{-6}$ per reactor-year, the applicant should provide a probabilistic analysis to determine the RPV failure frequency for axial welds.

The review procedures in the SRP-LR also indicate that, consistent with the staff’s supplemental SE, dated March 7, 2000, of the BWRVIP-05 report (March 7, 2000, evaluation), the staff ensures that the applicant’s plant is bounded by the BWRVIP-05 analysis or that the applicant has committed to a program to monitor axial weld embrittlement relative to the values specified by the staff in its supplemental SE of the BWRVIP-05 report.

The SRP-LR review procedures further state that the staff confirms that the applicant has addressed the following renewal AAI Item in the staff’s SE of the BWRVIP-74:

- Action Item 12: As indicated in the staff's March 7, 2000, letter to Carl Terry, a LR [license renewal] applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine the mean RT_{NDT} of the limiting axial beltline weld at the end of the extended period of operation is less than the values specified in Table 1 of this FSER [October 18, 2001, letter to C. Terry].

In its review, the staff noted that LRA Section 4.2.5 does not provide a comparison of axial weld failure probability parameters between the applicant’s analysis and the staff’s March 7, 2000, supplemental SE regarding the BWRVIP-05 report. Specifically, Table 3 of the supplemental SE addresses the reactor vessel failure frequencies due to axial weld failure determined in the staff’s assessment. However, the LRA does not discuss these staff-assessed failure frequencies in comparison with the applicant’s analysis results. In addition, the staff noted that the applicant did not provide a probabilistic analysis establishing that the reactor vessel failure frequency for axial welds is less than $5x10^{-6}$ per reactor-year in accordance with the staff’s March 7, 2000, supplemental SE.

By letter dated July 27, 2015, the staff issued RAI 4.2.5-1, requesting that the applicant justify why LRA Section 4.2.5 does not need to be revised to provide comparison of axial weld failure probability parameters between the applicant’s analysis and the staff’s supplemental SE, dated March 7, 2000. If the applicant’s failure probability comparison does not indicate that the reactor vessel failure frequency due to axial weld failure is less than $5x10^{-6}$ per reactor-year, the staff requested that the applicant provide one of the following:

- a plant-specific probabilistic analysis for axial weld failure, consistent with SRP-LR Section 4.2.3.1.5
- information demonstrating that loss of fracture toughness due to neutron irradiation embrittlement of axial welds does not affect the structural integrity of the reactor vessel for the period of extended operation

In its response dated August 26, 2015, the applicant stated that, subsequent to the staff's original SE, dated July 28, 1998, of the BWRVIP-05 report, additional failure probability assessments were prepared by the BWRVIP to more accurately determine the conditional failure probability of BWR axial welds. The applicant also indicated that the staff reviewed these BWRVIP-05 assessments and provided separate conditional failure probability assessments in the supplemental SE, dated March 7, 2000, for the BWRVIP-05 report. The applicant further indicated that the staff's assessments resulted in higher failure probabilities than the BWRVIP assessments and, therefore, are limiting.

In addition, the applicant stated that the staff determined that the reactor vessel failure frequency due to failure of the axial welds in the BWR fleet is no greater than $5.02x10^{-6}$ per reactor-year. The applicant stated that, because these assessments are applicable to LSCS, Units 1 and 2, they are identified as TLAAs requiring evaluation through the period of extended operation.

As described below, the applicant revised LRA Sections 4.2.5, 4.8 (references for TLAAs), A.4.2.5 (UFSAR supplement for axial weld failure probability analysis), A.2.1.20 (UFSAR supplement for the Reactor Vessel Surveillance program), and A.1.1 item 20 (identification of enhancements for the Reactor Vessel Surveillance program), as a part of its response to RAI 4.2.5-1.

In its response regarding the LSCS, Unit 2, axial weld failure probability analysis, the applicant revised LRA Section 4.2.5, including Table 4.2.5-2, to provide a comparison of the RT_{NDT} values associated with the failure probability analysis. The comparison indicates that the limiting Unit 2 axial weld mean RT_{NDT} at 54 EFPY (12.2 °F without margin) is less than the mean RT_{NDT} (91 °F without margin) that was determined for the limiting CB&I reactor vessel in the staff's March 7, 2000, supplemental SE. The applicant indicated that, because the mean RT_{NDT} from the staff assessment (91 °F) bounds the mean RT_{NDT} of the limiting Unit 2 axial weld (12.2 °F), the staff-assessed failure probability of $2.73x10^{-6}$ is bounding for Unit 2 axial welds at 54 EFPY, confirming that the failure probability is less than $5x10^{-6}$ reactor-year. The applicant further indicated that the limiting Unit 2 axial welds are Welds BD, BE, and BF in this analysis.

In addition, the applicant dispositioned the TLAA for LSCS, Unit 2, reactor vessel axial welds in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation. The applicant also revised UFSAR supplement Section A.4.2.5 accordingly to summarize the updated analysis for Unit 2.

In its review, the staff finds the applicant's response acceptable because (a) the applicant adequately compared the mean RT_{NDT} of the limiting LSCS, Unit 2, axial weld to the mean RT_{NDT} that was determined in the staff's March 7, 2000, supplemental SE, (b) the applicant also confirmed that, because the Unit 2 RT_{NDT} is bounded by the staff-assessed RT_{NDT}, the Unit 2 reactor vessel failure frequency due to axial weld failure is less than $5x10^{-6}$ per reactor-year as specified in the March 7, 2000, supplemental SE, and (c) the applicant adequately revised the LRA, consistent with its response. The staff also finds that the applicant's response adequately addresses, for Unit 2, AAI 12 in the staff's SE of the BWRVIP-74 report, consistent with SRP-LR Section 4.2.3.1.5.

In its response regarding the Unit 1 axial weld failure probability analysis, the applicant revised LRA Section 4.2.5, including Table 4.2.5-1, to provide a comparison of the RT_{NDT} values associated with the failure probability analysis. The comparison indicates that the limiting Unit 1 axial weld mean RT_{NDT} at 54 EFPY (139.9 °F without margin) is greater than the mean RT_{NDT} (114 °F without margin) that was determined for the limiting CE reactor, "Mod 2" variant, in the staff's March 7, 2000, supplemental SE of the BWRVIP-05 report.

The applicant indicated that, because the mean RT_{NDT} from the staff assessment (114 °F) does not bound the mean RT_{NDT} of the limiting LSCS, Unit 1, axial weld (139.9 °F for Welds 3-308A, B, and C), the staff-assessed failure probability of 5.02×10^{-6} is not bounding for the Unit 1 axial welds at 54 EFPY. The applicant further stated that the limiting Unit 1 axial welds are projected to reach the 114 °F mean RT_{NDT} value (without margin) at approximately 39.15 EFPY. For reference information, the applicant indicated that the Unit 1 cumulative neutron exposure through July 2015 is equivalent to 24.05 EFPY. LRA Section 1.1.3 also indicates that the LSCS, Unit 1, license expires at midnight on April 17, 2022.

In addition, the applicant dispositioned the TLAA for the LSCS, Unit 1, reactor vessel axial welds in accordance with 10 CFR 54.21(c)(1)(iii) to manage the effects of aging for the reactor vessel axial welds. The applicant indicated that the effects of aging on the Unit 1 reactor vessel axial welds will be managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and the Reactor Vessel Surveillance program. The applicant stated that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program includes periodic volumetric examinations and that the Reactor Vessel Surveillance program manages neutron embrittlement by monitoring neutron fluence and by ensuring that neutron embrittlement analyses are updated as necessary to evaluate bounding neutron fluence values.

The applicant further identified two enhancements of the Reactor Vessel Surveillance program for aging management of the LSCS, Unit 1, axial welds as follows:

- Enhancement 1: Prior to the period of extended operation, the applicant will establish a monitoring limit for neutron fluence at the limiting Unit 1 axial weld (currently 39.15 EFPY) that corresponds to the axial weld failure probability of 5.02×10^{-6} per reactor-year specified in the supplement to the final SE of the BWRVIP-05 report.
- Enhancement 2: Prior to 39.15 EFPY, the applicant will complete a probabilistic axial weld failure analysis for Unit 1 that demonstrates that the 60-year axial weld failure probability is no greater than 5.02×10^{-6} per reactor-year.

In its review, the staff identified the following issues related to the LSCS, Unit 1, axial weld failure probability analysis:

- The applicant's response did not provide a neutron fluence level (E > 1 MeV) that corresponds to 39.15 EFPY, up to which the applicant identified that Unit 1 is bounded by 5.02×10^{-6} per reactor-year.

- It was not clear whether operating restrictions will be established to ensure that the Unit 1 reactor is operated only within the neutron fluence range for which the applicant's analysis remains valid.
- It was not clear whether the applicant will submit the updated analysis for the staff's review and approval sufficiently in advance of the reactor vessel fluence level exceeding the fluence range for which the applicant's analysis remains valid.

By letter dated October 23, 2015, the staff issued RAI 4.2.5-1a, Parts 1 through 3, requesting that the applicant address these issues. In RAI 4.2.5-1a, Part 1, the staff asked the applicant to provide the neutron fluence value (E > 1 MeV) that corresponds to 39.15 EFPY. In RAI 4.2.5-1a, Part 2, the staff asked the applicant to clarify whether the applicant's program includes an enhancement to establish operating restrictions that will ensure the LSCS, Unit 1, reactor is operated within the neutron fluence range for which the analysis remains valid. In RAI 4.2.5-1a, Part 3, the staff asked the applicant to clarify whether it will submit an updated reactor vessel axial weld failure probability analysis for Unit 1 to the staff for review and approval sufficiently in advance of the time when the reactor vessel fluence level is projected to exceed the fluence range assumed in the original reactor vessel axial weld failure probability analysis for Unit 1 (e.g., submittal at least 3 years before the analysis is projected to become invalid).

The applicant responded to RAI 4.2.5-1a, Parts 1 through 3, in its letter dated October 29, 2015. In the response to RAI 4.2.5-1a, Part 1, the applicant indicated that $6.25x10^{17}$ n/cm^2 (E > 1 MeV) is the neutron fluence level that corresponds to 39.15 EFPY of power operations for LSCS, Unit 1, and to an axial weld failure probability of $5.02x10^{-6}$ per reactor-year for this unit. The applicant also revised LRA Section 4.2.5 (reactor vessel axial weld failure probability TLAA), Section B.2.1.20 (Reactor Vessel Surveillance program), and Sections A.2.1.20 and A.4.2.5 (UFSAR supplement descriptions for the TLAA and AMP) to specify this as the fluence limit for the axial weld failure probability analysis. The staff finds the applicant's response acceptable because the applicant provided the specific Unit 1 fluence limit that corresponds to an axial weld failure probability of $5.02x10^{-6}$ per reactor-year.

In its responses to RAI 4.2.5-1a, Parts 2 and 3, the applicant revised the enhancements of the Reactor Vessel Surveillance program to ensure the implementation of the following program enhancements:

- Enhancement 1: Establish a maximum fluence limit of $6.25x10^{17}$ n/cm^2 (39.15 EFPY) for monitoring the limiting Unit 1 axial welds to ensure that the axial weld failure probability will not exceed $5.02x10^{-6}$ per reactor-year. This enhancement will be implemented prior to the period of extended operation.
- Enhancement 2: Complete a probabilistic axial weld failure analysis for Unit 1 that demonstrates the 60-year axial weld failure probability is no greater than $5.02x10^{-6}$ per reactor-year. Submit the analysis to the NRC for review and approval. This enhancement will be implemented at least 3 years prior to the limiting axial welds reaching the fluence limit specified above.

The staff noted that the applicant also incorporated these revised enhancements into LRA Sections A.2.1.20 and A.4.2.5, which provide the UFSAR supplement descriptions for the Reactor Vessel Surveillance program and the reactor vessel axial weld failure probability TLAA, and into Commitment No. 20 in UFSAR supplement Table A.5. The applicant stated that the implementation of the applicant's commitment tracking assignments will ensure that these procedurally controlled operating restrictions are established before the period of extended operation, which is estimated to be approximately 9 years before reaching a failure probability of $5.02x10^{-6}$ per reactor-year. The applicant also revised LRA Section 4.2.5 to state that the reactor vessel axial weld failure probability TLAA for LSCS, Unit 1, is acceptable in accordance with the TLAA acceptance criterion in 10 CFR 54.21(c)(1)(iii). Specifically, the applicant amended LRA Section 4.2.5 to state that combined activities in LRA AMP B.2.1.20, "Reactor Vessel Surveillance Program"; LRA AMP B.2.1.1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program"; and the programmatic enhancements of LRA Commitment No. 20 are adequate and will be used to manage loss of fracture toughness in the reactor vessel axial shell welds of Unit 1 during the period of extended operation.

The staff determined that these AMPs, as subject to the programmatic enhancements in LRA Commitment No. 20, provide an acceptable basis for dispositioning this TLAA in accordance with 10 CFR 54.21(c)(1)(iii) because (a) the applicant established an appropriate operational neutron fluence limit of $6.25x10^{17}$ n/cm^2 (E > 1 MeV) for axial shell welds in the LSCS, Unit 1, reactor vessel, (b) the establishment of this limit will ensure that the actual neutron fluence for the limiting reactor vessel axial shell welds in the unit will not exceed the specified neutron fluence assumed in the failure probability TLAA for the welds, (c) the applicant will complete and submit an updated reactor vessel axial weld failure probability analysis for Unit 1 to the staff for review and approval at least 3 years before reaching the fluence limit specified above, and (d) the applicant has adequately defined and described appropriate programs and enhanced programmatic activities in LRA Commitment No. 20 that will be used to manage loss of fracture toughness in these reactor vessel axial shell welds during the period of extended operation. Therefore, based on this review, the staff finds that the applicant has demonstrated that the reactor vessel axial weld failure probability TLAA for Unit 1 is acceptable in accordance with 10 CFR 54.21(c)(1)(iii) because the applicant has demonstrated that the impacts of loss of fracture toughness on the intended reactor coolant pressure boundary functions of the reactor vessel axial shell welds will be adequately managed during the period of extended operation. The staff's concerns in RAI 4.2.5-1a, Parts 1 through 3 are resolved.

4.2.5.3 UFSAR Supplement

LRA Section A.4.2.5 provides the UFSAR supplement summarizing the TLAA evaluation of the reactor vessel axial weld failure probability analysis. The staff reviewed LRA Section A.4.2.5, consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer should verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

As discussed in Section 4.2.5.2 of this SER, the applicant revised LRA Section A.4.2.5 (UFSAR supplement) in its letter dated August 26, 2015, and subsequently in its letter dated October 29, 2015. Specifically, the staff noted that, in the letter dated August 26, 2015, the applicant revised the UFSAR supplement to indicate that the reactor vessel axial weld failure probability analysis for LSCS, Unit 2, was dispositioned in accordance with the acceptance criterion in 10 CFR 54.21(c)(1)(ii). The staff found this revision acceptable because the staff confirmed that the applicant appropriately projected the Unit 2 axial weld failure probability analysis to the end of the period of extended operation and demonstrated that the mean RT_{NDT} value for the welds is bounded by the limiting mean RT_{NDT} value for reactor vessel axial shell welds cited in the NRC SE, dated March 7, 2000, of the BWRVIP-05 report. Thus, the staff finds that the revised UFSAR supplement adequately summarizes the TLAA on the Unit 2 axial weld failure probability analysis.

The staff noted some issues regarding the applicant's TLAA evaluation on the LSCS, Unit 1, axial weld failure analysis, as described above. The staff further noted that, in the letter dated October 29, 2015, the applicant resolved these issues by amending the acceptance basis for the Unit 1 reactor vessel axial weld failure probability TLAA from 10 CFR 54.21(c)(1)(ii) to 10 CFR 54.21(c)(1)(iii). As previously discussed in Section 4.2.5.2, the staff found that, based on the applicant's revisions to LRA Section 4.2.5, LRA UFSAR Supplement Section A.4.2.5, and Commitment No. 20 in LRA Table A.5, the applicant has provided adequate demonstration that the reactor vessel axial weld failure probability TLAA for Unit 1 is acceptable in accordance with 10 CFR 54.21(c)(1)(iii) and that loss of fracture toughness due to neutron irradiation embrittlement in these welds will be adequately managed during the period of extended operation.

Therefore, based on the staff's review of the revised UFSAR supplement in the letters dated August 26, 2015, and October 29, 2015, the staff finds that the applicant provided an acceptable UFSAR supplement summary description of the reactor vessel axial weld failure probability TLAAs that apply to LSCS, Units 1 and 2, as required by 10 CFR 54.21(d).

4.2.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an adequate demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the LSCS, Unit 2, reactor vessel axial weld failure probability analysis has been projected to the end of the period of extended operation and that, pursuant to 10 CFR 54.21(c)(1)(iii), the effects of aging on the intended functions of the Unit 1 reactor vessel axial welds will be adequately managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and the Reactor Vessel Surveillance program (with enhancements) for 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).

4.2.6 Circumferential Weld Failure Probability Assessment Analyses

4.2.6.1 Summary of Technical Information in the Application

LRA Section 4.2.6 describes the applicant's TLAA for reactor vessel circumferential weld failure probability assessments. The technical information in LRA Section 4.2.6 is summarized as follows.

LSCS previously applied for relief from the circumferential weld inservice inspection requirements for the Unit 1 reactor vessel manufactured by CE and for the Unit 2 reactor vessel manufactured by CB&I. The relief request was granted, as described in the staff's SE, dated January 28, 2004.

In the circumferential weld failure probability assessments for 60 years of operation, the applicant stated that the 54-EFPY neutron fluence values for the reactor vessels were calculated using the RAMA neutron methodology, as described in LRA Section 4.2.1. The applicant stated that the mean RT_{NDT} values for the circumferential welds at 54 EFPY are bounded by the staff's assessments that are described for CE- and CB&I-designed reactor vessels in the July 28, 1998, SE for the BWRVIP-05 report, as consistent with the guidance in GL 98-05. The applicant also stated that the comparison of these mean RT_{NDT} values confirms that the conditional failure probabilities for LSCS reactor vessel circumferential welds are bounded by the conditional failure probabilities for the limiting CE and CB&I reactor vessels assessed in the July 28, 1998, SE.

The applicant dispositioned the TLAA for the reactor vessel circumferential welds in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions will be adequately managed by a relief request from inservice inspection requirements in accordance with the 10 CFR 50.55a process.

4.2.6.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor vessel circumferential welds and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.2.3.1.4. The SRP-LR states that the staff verifies that the applicant has identified that, if the inspection relief is desired for the period of extended operation, an application will be made pursuant to 10 CFR 50.55a before the plant enters the period of extended operation. SRP-LR Section 4.2.3.1.4 also states that, if the applicant indicates that relief from circumferential weld examination requirements will be made pursuant to 10 CFR 50.55a, the applicant will manage this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

In its review, the staff noted that LRA Table 4.2.6-1 provides a comparison between the mean RT_{NDT} value (-11 °F) for Unit 1 limiting circumferential weld (Weld 6-308) at 54 EFPY and the staff-calculated mean RT_{NDT} value (128.9 °F) in the assessment for the limiting CE reactor vessel that is documented in the July 28, 1998, SE for the BWRVIP-05 report. The staff also noted that LRA Table 4.2.6-2 provides a comparison between the mean RT_{NDT} value (-11 °F) for the Unit 2 beltline circumferential weld (Weld AB) at 54 EFPY and the staff-calculated mean RT_{NDT} value (70.6 °F) in the assessment of the limiting CB&I reactor vessel that is documented in the July 28, 1998, SE. The LRA also indicates that Weld AB is the only circumferential weld in the Unit 2 beltline region.

As discussed above, the staff confirmed that the applicant provided adequate comparison between the mean RT_{NDT} values of LSCS reactor vessel circumferential welds at 54 EFPY and the staff-determined mean RT_{NDT} values for the circumferential welds of limiting CE and CB&I reactor vessels at 64 EFPY. In its review, the staff confirmed that the mean RT_{NDT} value for each unit at 54 EFPY is less than the applicable staff-determined mean RT_{NDT} value at 64 EFPY in the July 28, 1998, SE. The staff finds that the conditional failure probability for reactor vessel circumferential welds at each unit is bounded by the staff-determined conditional failure probability for the corresponding limiting analysis; therefore, the failure probability assessments are acceptable.

The staff also noted that LRA Section 4.2.6 indicates that the applicant will reapply for inservice inspection relief from circumferential weld examination requirements pursuant to 10 CFR 50.55a for NRC review and approval before the period of extended operation. The staff noted that the applicant's basis for resubmitting an applicable inspection relief request for these welds during the period of extended operation is consistent with the guidance described in SRP-LR Section 4.2.3.1.4 and with the relief request requirements in 10 CFR 50.55a. The staff also noted that, consistent with the guidelines in SRP-LR Section 4.2.3.1.4, the applicant's resubmittal of an inspection relief request provides an adequate basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii). Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of reactor vessel circumferential welds will be adequately managed for the period of extended operation.

Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.3.1.4 because (a) the applicant's analysis in LRA Section 4.2.6 confirms that the conditional failure probability values for LSCS reactor vessel circumferential welds at 54 EFPY are bounded by the staff-accepted conditional failure probability values that are described in the July 28, 1998, SE for the BWRVIP-05 report and (b) the applicant confirmed that it will request relief from the requirements to perform volumetric examinations of the circumferential welds in accordance with 10 CFR 50.55a before the plant enters the period of extended operation.

4.2.6.3 UFSAR Supplement

LRA Section A.4.2.6 provides the UFSAR supplement summarizing the TLAA evaluation on the reactor vessel circumferential weld failure probability assessment. The staff reviewed LRA Section A.4.1.6, consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer should verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the neutron embrittlement TLAA.

The staff verified that the UFSAR supplement provides a sufficient summary description of the TLAA and is consistent with the basis in the staff's SE regarding the BWRVIP-05 report. The staff also confirmed that the UFSAR supplement appropriately reflects that any inservice inspection relief for these welds will be resubmitted to justify elimination of the inservice inspection requirements before the period of extended operation. In addition, the staff confirmed that the UFSAR supplement adequately identifies resubmittal of the relief request for the circumferential welds as adequate basis for disposition of this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.2.3.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA on the reactor vessel circumferential weld inspection, as required by 10 CFR 54.21(d).

4.2.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant provided an adequate demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of fracture toughness on the intended functions of the reactor vessel circumferential welds will be adequately managed by the inservice inspection relief request process for 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).

4.2.7 Reactor Pressure Vessel Reflood Thermal Shock Analyses

4.2.7.1 Summary of Technical Information in the Application

LRA Section 4.2.7 describes the applicant's TLAA for RPV reflood thermal shock analysis (RPV reflood analysis). The technical information that the applicant provided in the LRA is summarized in this section as follows.

General Design Criterion 31, “Fracture prevention of reactor coolant pressure boundary,” of Appendix A to 10 CFR Part 50, requires that the reactor coolant pressure boundary of a light water reactor be designed with adequate margins of safety against non-ductile failure. The applicant stated that this requirement was demonstrated for GE-designed BWRs by development of both P-T limits (LRA Section 4.2.4) and generic fracture mechanics analyses that evaluate the effects of the limiting loss-of-coolant accident (LOCA) event.

The applicant stated that postulated sudden rupture due to a main steam line LOCA was determined to be bounding for all other LOCA events in these fracture mechanics analyses. Several emergency core cooling systems are activated at different times after the LOCA, and the reactor vessel is flooded with cooling water. The applicant stated that the resulting RPV blowdown and the subsequent injection of cold water produce low temperature and high thermal stresses in the reactor vessel.

The applicant stated acceptance criterion used in the fracture mechanics analyses is that the crack driving force (stress intensity factor, $K_{I\text{-applied}}$) for postulated flaws in the RPV, present during the bounding emergency or faulted condition, is less than the limiting material resistance to fracture, K_{Ic}, applicable during the event. The applicant stated that the limiting K_{Ic} fracture toughness, as calculated as a function of crack tip temperature and fluence level, was determined to be significantly higher than the applied stress intensity factor at all times during the progression of emergency and faulted condition transients evaluated in the analysis.

The applicant dispositioned this TLAA for the RPV reflood thermal shock in accordance with 10 CFR 54.21(c)(1)(ii) to demonstrate that the analysis has been projected to the end of the period of extended operation.

4.2.7.2 Staff Evaluation

The staff reviewed the applicant’s TLAA and the corresponding disposition of 10 CFR 54.21(c)(1)(ii) to ensure that the analysis has been projected to the end of the period of extended operation.

LRA Section 4.2.7 indicates that the generic fracture mechanics analyses for RPV reflood thermal shock LOCA events are described in the following references: (1) NEDO-10029, “An Analytical Study on Brittle Fracture of GE-BWR Vessel Subject to the Design Basis Accident,” dated 1969, and (2) Ranganath, S., “Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident,” Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979. The applicant also indicated that the applicant performed an updated reflood thermal shock analysis for license renewal that is bounding for LSCS, Units 1 and 2. The applicant further indicated that the updated analysis includes RPV beltline shells and nozzles.

LRA Section 4.2.7 also includes a discussion of the criteria and methodology used in the analysis. The LRA indicates that the RPV reflood analysis for the RPV beltline materials uses a conservative factor of 1.414 for the evaluation of ASME Code Service Level D loadings (i.e., faulted condition loadings), consistent with the flaw evaluation rules specified in ASME Code Section XI, IWB-3600. The crack driving force (stress intensity factor), $K_{I\text{-applied}}$, is compared to the adjusted Mode I plane-strain fracture toughness, $K_{Ic}/1.414$ (as conservatively adjusted by a factor of 1.414). This comparison is performed to demonstrate that the postulated flaws are stable without non-ductile crack propagation. The applicant also indicated that K_{Ia} (crack arrest fracture toughness) and K_{Ic} (crack initiation fracture toughness) values are calculated using the equations in ASME Code Section XI, Non-mandatory Appendix A, and a through-wall temperature distribution that is applicable to the time-dependency of the analyzed transients in the RPV reflood analysis.

In its review, the staff noted that the LRA does not provide the following information regarding the parameters and methods used in the analysis: (1) the maximum depth of the postulated flaw, (2) any conservative factor used in the analysis involving ASME Code Service Level C loading (emergency condition), and (3) the method used to calculate neutron fluence attenuation through RPV thickness when fluence attenuation is considered. By letter dated July 7, 2015, the staff issued RAI 4.2.7-1, requesting that the applicant provide information on the items described above.

In its response dated August 6, 2015, the applicant clarified that the maximum flaw depth used in the analysis for LSCS, Units 1 and 2, is 5.2 percent of the RPV wall thickness, consistent with the criteria in ASME Code Section XI, Tables IWB-3510-1 and IWB-3512-1. The applicant also clarified that, for the ASME Code Service Level C loadings (i.e., for emergency condition loadings) in the analysis, the applied stress intensity factor, $K_{I\text{-}applied}$, is compared with the adjusted fracture toughness value, $K_{Ic}/1.414$, where the crack initiation fracture toughness, K_{Ic}, has been reduced conservatively by a safety factor of 1.414. The applicant further clarified that this approach is consistent with the crack initiation criterion specified in ASME Code Section XI, IWB-3612(b). In addition, the applicant clarified that the fluence attenuation for the RPV wall thickness is computed in accordance with the guidance described in RG 1.99, Revision 2 (i.e., Equation 3 of RG 1.99).

In its review, the staff finds that the applicant’s response acceptable because (1) the postulated flaw depth in the applicant’s analysis is consistent with the maximum allowable depth for RPV planar flaws specified in ASME Code Section XI, Table IWB-3510-1 and IWB-3512-1, (2) the use of fracture toughness conservatively adjusted by a factor of 1.414 is consistent with ASME Code Section XI, IWB-3612(b), and (3) the method used for calculation of neutron fluence attenuation in the analysis is consistent with the guidance described in RG 1.99, Revision 2. The staff’s concern described in RAI 4.2.7-1 is resolved.

LRA Section 4.2.7 also describes the applicant’s evaluation of the integrity of RPV shell materials during a main steam line break LOCA as follows.

In the evaluation of the main steam line break analysis, the applicant indicated that the bounding 54-EFPY inside surface (0T) neutron fluence values are used to calculate the limiting ART for LSCS, Units 1 and 2 (i.e., 168 °F). The applicant also indicated that, based on the limiting ART, the allowable fracture toughness value, $K_{Ic}/1.414$, is 141 ksi√in. for the limiting material (weld heat 1P3571) and this limiting fracture toughness value (141 ksi√in.) is greater than the maximum $K_{I\text{-}applied}$ (105 ksi√in.) during the main steam line break transient. Therefore, the applicant concluded that the postulated flaw in either the Unit 1 or Unit 2 RPV would be stable without non-ductile crack propagation during the main steam line break transient.

In its review, the staff finds that the LRA, as supplemented by letter dated August 6, 2015 (applicant’s response to RAI 4.2.7-1), confirms that the applicant adequately projected the main steam line break LOCA analysis to the end of the period of extended operation, consistent with the guidance in RG 1.99, Revision 2 and the analytical flaw evaluation methodology in ASME Code Section XI.

LRA Section 4.2.7 further describes the applicant's evaluation of integrity of RPV shell materials during a recirculation line break LOCA as follows.

In its evaluation, the applicant indicated that the fracture mechanics analysis of the recirculation line break LOCA was updated with the material properties projected for 60 years of operation (54 EFPY). The applicant also indicated that the fracture toughness (K_{Ic}) values of the RPV materials are determined using crack-tip temperature at the maximum allowable crack depth and that the ART is based on the limiting inside surface (0T) neutron fluence.

The applicant's analysis also compared the applied stress intensity factor at the crack tip, $K_{I\text{-}applied}$, to the conservatively reduced fracture toughness value, $K_{Ic}/1.414$. The applicant indicated that, at 480 and 1,200 seconds after the start of the transient, the $K_{I\text{-}applied}$ value exceeds the $K_{Ic}/1.414$ value by 40 percent, which thus indicates that crack initiation and propagation would occur during that time period. However, the applicant further indicated that, because neutron fluence actually attenuates as a function of distance from the RPV inside surface, additional analysis was performed to take into account the reduced fluence as a function of crack depth. The applicant provided the following analysis on crack arrest to confirm that, even if a crack is initiated, the crack propagation will be arrested before it reaches 75 percent of the RPV wall thickness (0.75T). The applicant stated that the crack arrest within the 75-percent wall thickness is consistent with the crack arrest acceptance criteria described in ASME Code Section XI (e.g., ASME Code Section XI, Appendix A, A-5000).

In the crack arrest analysis, the applicant indicated that, at times of 480 seconds and 1,200 seconds after the start of the transient, the K_{Ic} (crack initiation fracture toughness) and K_{Ia} (crack arrest fracture toughness) values are determined as a function of crack depth, as well as associated temperature, fluence, and ART. In LRA Figures 4.2.7-1 and 4.2.7-2, the applicant also plotted $K_{I\text{-}applied}$ (applied stress intensity factor) in comparison with K_{Ic} and K_{Ia} at transient times of 480 and 1,200 seconds, respectively.

The staff noted that these plots indicate that, at times of 480 and 1,200 seconds, shallow cracks may be initiated to propagate but that crack arrest will occur ($K_{I\text{-}applied} < K_{Ia}$) well before the cracks reach a depth of 75-percent vessel wall thickness, consistent with the crack arrest acceptance criteria of ASME Code Section XI (i.e., crack arrest within 75-percent wall thickness during the emergency and faulted conditions). The staff also noted that the applicant's analysis demonstrates that the RPV shell components at Units 1 and 2, as bounded by the limiting weld material (Heat No. 1P3571), will continue to have considerable margins of safety against postulated brittle fracture failures for the period of extended operation.

In its review of the recirculation line break analysis, the staff noted that the following item needed additional clarification. LRA Table 4.2.7-2 and associated discussion in LRA Section 4.2.7 have a reference to the 52-percent wall thickness location for the evaluation of applied stress intensity factor ($K_{I\text{-}applied}$). The LRA also compares the $K_{I\text{-}applied}$ values at 52-percent wall thickness to the adjusted fracture toughness values ($K_{Ic}/1.414$) of the limiting RPV material. It was not clear to the staff why LRA Table 4.2.7-2 and Section 4.2.7 refer to the location at 52 percent of the RPV wall thickness for the fracture toughness comparison rather than 5.2 percent of the wall thickness that corresponds to the postulated initial flaw depth.

By letter dated September 14, 2015, the staff issued RAI 4.2.7-1a, Part 1, requesting that the applicant clarify why LRA Table 4.2.7-2 and associated discussion in Section 4.2.7 assume a flaw depth of 52-percent wall thickness that is different from the postulated initial flaw depth (i.e., 5.2 percent of the RPV wall thickness).

The applicant responded to RAI 4.2.7-1a, Part 1, by letter dated October 8, 2015. In its response, the applicant identified the listing of a postulated 52-percent flaw size in LRA Section 4.2.7 as a typographical error and that postulated flaw size should have been identified as a 5.2 percent of the RPV wall thickness. The applicant amended LRA Section 4.2.7 to identify that the postulated flaw size in the RPV reflood analyses was 5.2 percent of RPV wall thickness. The staff determined that the applicant's response to the RAI and amendment of the LRA are acceptable because the postulated initial flaw size for the reflood analysis is now consistent with that evaluated in the design report for the reflood analysis (i.e., with that reported in GE Report NEDO-10029). RAI 4.2.7-1a, Part 1, is resolved.

In addition, LRA Section 4.2.7 describes the applicant's analysis of the RPV beltline nozzles for the design basis LOCA. The applicant indicated the N6 LPCI nozzles are determined as the limiting beltline nozzles because the emergency core coolant system injects coolant through these nozzles following a LOCA. The applicant also indicated that the finite element analysis results documented in the stress analyses of LSCS, Units 1 and 2, are used in the applicant's fracture mechanics analysis. The applicant indicated that the bounding temperature distribution in the LPCI nozzles was used to develop a thermal stress distribution, which is, in turn, used to calculate the stress intensity factor for the fracture mechanics analysis. The applicant stated that the resulting applied stress intensity factor ($K_{I\text{-applied}}$) value is significantly less than the allowable fracture toughness value, $K_{Ic}/1.414$, thus demonstrating adequate margin against non-ductile fracture for these nozzles.In its review, the staff noted that LRA Section 4.2.7 does not provide the $K_{I\text{-applied}}$ and $K_{Ic}/1.414$ values determined in the applicant's analysis. By letter dated September 14, 2015, the staff issued RAI 4.2.7-1a, Part 2, requesting that the applicant provide the $K_{I\text{-applied}}$ and $K_{Ic}/1.414$ values for the LPCI nozzles to confirm the adequacy of the analysis.

The applicant responded to RAI 4.2.7-1a, Part 2, by letter dated October 8, 2015. In its response, the applicant amended the part of the RPV reflood analysis that applies to the N6 LPCI nozzle in the RPVs. The applicant indicated that the projected applied stress intensity value for the postulated flaw in the N6 LPCI nozzles is approximately 35 ksi√in. at 3,000 seconds and that applied stress intensity value is less than the conservatively adjusted fracture toughness value ($K_{IC}/1.414$) of 141 ksi√in.

The staff noted that the applicant's response to RAI 4.2.7-1a, Part 2, and amendment of the LRA appropriately demonstrate that the stress intensity value for the limiting nozzle component in RPV reflood analysis has been projected to the end of the period of extended operation and will remain bounded by the conservatively adjusted fracture toughness value ($K_{IC}/1.414$) of 141 ksi√in. Therefore, based on this review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the RPV reflood analysis for the RPV components has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.1 because (1) the applicant has projected a stress intensity value for the limiting RPV component in analysis to the end of the period of extended operation and (2) the stress intensity value remains bounded by the fracture toughness value of the nozzle components. RAI 4.2.7-1a, Part 2, is resolved.

4.2.7.3 UFSAR Supplement

LRA Section A.4.2.7 provides the UFSAR supplement summarizing the TLAA that applies to the RPV reflood analysis. The staff reviewed LRA Section A.4.2.7, consistent with the review procedures in SRP-LR Section 4.2.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the TLAA evaluation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.3.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for the reactor vessel reflood thermal shock, as required by 10 CFR 54.21(d).

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the RPV reflood 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).

4.2.8 RPV Core Plate Rim Hold-Down Bolt Loss of Preload Analysis

4.2.8.1 Summary of Technical Information in the Application

LRA Section 4.2.8 describes the applicant's TLAA for the loss of preload analysis of the RPV core plate rim hold-down bolts resulting from irradiation effects. The LRA states that a 54-EFPY fluence evaluation has identified the hold-down bolts with the highest fluence values after 60 years of operation for LSCS, Units 1 and 2. The highest average fluence value for a Unit 1 bolt is 3.60×10^{19} n/cm^2. The highest average fluence value for a Unit 2 bolt is 3.85×10^{19} n/cm^2. The LRA also states that an average fluence value of 8.0×10^{19} n/cm^2, which was projected for 40 years of operation, results in a maximum relaxation of 19 percent in preload for the RPV core plate rim hold-down bolts. The loss of preload analysis was performed as part of EPRI BWRVIP-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines."

The applicant dispositioned the TLAA for the loss of preload analysis for the RPV core plate rim hold-down bolts in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.2.8.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the loss of preload analysis of the RPV core plate rim hold-down bolts resulting from irradiation effects and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.7.3.1.1. These procedures state that the staff is to review the justification provided by the applicant to verify that the existing analyses are valid during the period of extended operation. SRP-LR Section 4.7.3.1.1 also states that the existing analysis should be shown to be bounding during the period of extended operation.

The staff issued the final SEs for the BWRVIP-25 report (EPRI TR-107284, dated December 1996) and its associated Appendix B, "BWR Core Plate Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR 54.21)," by letters dated December 19, 1999, and December 7, 2000, respectively. Section 2.1.3 of the BWRVIP-25 report states that it has been determined that a 5 percent to 19 percent reduction in preload is expected over a 40-year operating experience and that the bolts will maintain some preload throughout the life of the plant. Section B.4 of

Appendix B to the BWRVIP-25 report states that the loss of preload was recalculated based on 60 years of plant operation and that the reduction in preload remains 5 percent to 19 percent. However, there are no corresponding fluence values provided for the percent reductions of preload in either the BWRVIP-25 report or the appendices of the report. By letter dated August 18, 2015, the staff issued RAI 4.2.8-1, requesting that the applicant provide the analysis used to determine that an average fluence value of 8.0×10^{19} n/cm^2 produces a maximum relaxation of 19 percent in preload for the RPV core plate rim hold-down bolts.

In its response dated September 15, 2015, the applicant stated that the analysis, used to determine that an average fluence value of 8.0×10^{19} n/cm^2 produces a maximum relaxation of 19 percent in preload for the RPV core plate rim hold-down bolts, is summarized in a letter dated June 29, 2006 (GE-EN-0000-0055-6793), from GE Nuclear Energy to EPRI with the subject of "Relaxation of Core Plate Rim Hold-down Bolts." The RAI response quotes the letter as stating:

> [T]he original fluence estimates that were used to derive the amount of relaxation were not bounding for the plant-specific conditions, including the effects of power uprate and the additional exposure associated with the period of extended operation. As a result, GE has re-evaluated the maximum relaxation value of 19%, and determined that this value is applicable to an average fluence level of 8E19 n/cm^2 over the entire length of the bolt, determined at the peak azimuthal fluence location.

The RAI response also notes the conclusion of the letter, which states:

> Evaluation of core plate bolt relaxation has determined that the maximum reported relaxation value of 19% remains valid to an average fluence value of 8E19 n/cm^2 or less. This fluence is an average fluence over the entire length of the core plate bolt. Plant-specific evaluations required for license renewal, or other structural evaluation, should incorporate this limitation.

The RAI response further states that LSCS, Units 1 and 2, are both BWR Type 5 (BWR/5) units and that the analysis described in the BWRVIP-25 report is applicable for all BWR/5 units.

The staff reviewed the applicant's response and finds it acceptable because the source document that established that an average fluence level of 8.0×10^{19} n/cm^2 produces a maximum relaxation of 19 percent in preload has been identified. The response also confirms that the loss of preload evaluation is bounded by the BWRVIP-25 report and its appendices because the configuration of the rim hold-down bolts and average fluence levels of both units are within the limitations of the analysis.

The highest average fluence values for the RPV core plate rim hold-down bolts were determined using RAMA fluence projections for both LSCS, Units 1 and 2. The 54-EFPY fluence evaluation was performed for all 34 core plate rim bolts in each unit. The staff's evaluation of neutron fluence analyses is in SER Section 4.2.1.

Accordingly, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis of the loss of preload for the RPV core plate rim hold-down bolts resulting from irradiation effects remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the fluence value of 8.0×10^{19} n/cm^2

used in the existing analysis is shown to be bounding for both LSCS, Units 1 and 2, during the period of extended operation.

4.2.8.3 UFSAR Supplement

LRA Section A.4.2.8 provides the UFSAR supplement summarizing the loss of preload for the RPV core plate rim hold-down bolts. The staff reviewed LRA Section A.4.2.8, consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer is to verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address loss of preload for the RPV core plate rim hold-down bolts, as required by 10 CFR 54.21(d).

4.2.8.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis of the loss of preload for the RPV core plate rim hold-down bolts resulting from irradiation effects remains valid for 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).

4.2.9 Jet Pump Riser Brace Clamp Loss of Preload Analysis

4.2.9.1 Summary of Technical Information in the Application

LRA Section 4.2.9 describes the applicant's TLAA for the loss of preload of the jet pump riser brace clamp resulting from neutron irradiation. The LRA states that the original 40-year design evaluation for the clamp used a neutron fluence value of 3.2×10^{20} n/cm^2 to determine that a 46-percent loss of preload would occur. The applicant performed a neutron fluence evaluation for 54 EFPY on the LSCS, Unit 1, jet pump riser brace clamp and projected that after 60 years of operation (54 EFPY) the neutron fluence value will be 2.0×10^{20} n/cm^2.

The applicant dispositioned the TLAA for the loss of preload of the jet pump raiser brace clamp in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.2.9.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the loss of preload of the jet pump raiser brace clamp resulting from irradiation effects and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.7.3.1.1. These procedures state that the staff must review the justification provided by the applicant to verify that the existing analyses are valid during the period of extended operation. SRP-LR Section 4.7.3.1.1 also states that the existing analysis should be shown to be bounding during the period of extended operation.

The staff reviewed UFSAR Sections 3.9.5.1.8 and 4.5.2.1. The review of the UFSAR confirmed the installation of the jet pump raiser brace clamps in LSCS, Unit 1, and their material of construction. The staff noted that the 54-EFPY fluence value of 2.0×10^{20} n/cm^2 for the jet pump raiser brace clamp was determined using the RAMA fluence methodology. The staff also noted that the neutron fluence evaluation was performed using the specific geometry of the jet pump and riser brace clamps. The staff further noted that the 54-EFPY fluence value of 2.0×10^{20} n/cm^2 is bounded by the original 40-year design value of 3.2×10^{20} n/cm^2. The staff's evaluation of neutron fluence analyses is in SER Section 4.2.1.

Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis of the loss of preload for the jet pump raiser brace clamp resulting from irradiation effects remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the fluence value of 3.2×10^{20} n/cm^2 used in the existing design analysis is shown to be bounding for the period of extended operation.

4.2.9.3 UFSAR Supplement

LRA Section A.4.2.9 provides the UFSAR supplement summarizing the loss of preload for the jet pump raiser brace clamp. The staff reviewed LRA Section A.4.2.9 consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer is to verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address loss of preload for the jet pump raiser brace clamp, as required by 10 CFR 54.21(d).

4.2.9.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis of the loss of preload for the jet pump raiser brace clamp resulting from irradiation effects remains valid for 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).

4.2.10 Jet Pump Slip Joint Repair Clamp Loss of Preload Analysis

4.2.10.1 Summary of Technical Information in the Application

LRA Section 4.2.10 describes the applicant's TLAA for the loss of preload analysis of the jet pump slip joint repair clamp resulting from irradiation effects. The LRA states that the function of the clamp is to apply a lateral preload to the slip joint to minimize slip joint vibrations and wear of the jet pump assemblies. The applicant stated that the clamps were installed with a preload of 500 lb and that the design specification requires a minimum preload of 350 lb at the end of life. The applicant also stated that this allowable 30-percent relaxation in preload corresponds to a fluence value of 1.17×10^{20} n/cm^2 based on Figure 6-4 of EPRI BWRVIP-276, "Evaluation to Justify Core Plate Bolt Inspection Elimination," which provides the relationship between neutron fluence and stress relaxation for stainless steel. The applicant further stated that the projected fluence value for the clamp at the end of the period of extended operation is 1.27×10^{20} n/cm^2.

The applicant dispositioned the TLAA for the jet pump slip joint repair clamp in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of loss of preload on the intended function(s) will be adequately managed for the period of extended operation.

4.2.10.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the loss of preload of the jet pump slip joint repair clamp resulting from irradiation effects and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.7.3.1.3. These procedures state that the staff must review the AMP proposed by the applicant to verify that the program is adequate to manage the aging effects associated with the TLAA. SRP-LR Section 4.7.3.1.3 also states that the applicant must identify components associated with the TLAA and must describe relevant aspects of the analysis.

The LRA provides the relevant aspects of the TLAA, such as the applicable aging effect, intended function(s) of the clamp, and design acceptance criteria. The LRA states that the first clamp was installed in the RPV of LSCS, Unit 1, in February 2004 and that the original analysis predicted a 12-percent reduction in preload at the end of the 40-year license period based on a projected fluence level of 4.4×10^{19} n/cm^2. The design specification for the clamp allows a 30-percent reduction in preload, which the applicant determined would be reached at a fluence level of 1.17×10^{20} n/cm^2 before 60 years of plant operation. By letter dated August 18, 2015, the staff issued RAI 4.2.10-1, requesting that the applicant identify the program or a set of activities that will be used for the jet pump slip joint repair clamp to ensure that the limiting fluence value (1.17×10^{20} n/cm^2) is not exceeded.

In its response dated September 15, 2015, the applicant stated that the activities that will be used to ensure that the jet pump slip joint repair clamp does not exceed its limiting fluence value are (1) action tracking assignments for Commitment No. 47 in the Exelon commitment management program and (2) procedure LTS-1200-4, "Reactor Engineer's Core Monitoring Surveillance." The response also states that the action tracking assignments for Commitment No. 47 will include an assignment to ensure that corrective actions are taken to repair, replace, or reanalyze the clamps well in advance of reaching the fluence level of 1.17×10^{20} n/cm^2 (50.7 EFPY). The due date to initiate this assignment will be approximately 5 years before the estimated calendar date that the fluence limit is reached. Procedure LTS-1200-4 requires the EFPY value for LSCS, Unit 1, to be updated each month and reported to the Reactor Internals Engineer. The response further states that procedure LTS-1200-4 will be revised before the plant enters the period of extended operation to require the Reactor Internals Engineer to ensure that corrective action has been taken before exceeding 50.7 EFPY.

The staff reviewed the applicant's response and finds it acceptable because the applicant has provided its set of activities that will be used to ensure that the fluence limit is not exceeded. The set of activities described by the applicant will ensure that the intended function(s) of the jet pump slip joint repair clamp are maintained during the period of extended operation.

The highest fluence value for the limiting slip joint repair hardware was determined using RAMA three-dimensional fluence projections. The staff's evaluation of the neutron fluence analyses is in SER Section 4.2.1.

Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of the loss of preload on the intended functions of the jet pump slip joint repair clamp will be adequately managed for the period of extended operation.

4.2.10.3 UFSAR Supplement

LRA Section A.4.2.10 provides the UFSAR supplement summarizing the loss of preload for the jet pump slip joint repair clamp. The staff reviewed LRA Section A.4.2.10, consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the reviewer must verify that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the TLAA. The staff also noted that the applicant committed (Commitment No. 47) to take corrective actions before the fluence limit of $1.17x10^{20}$ n/cm^2 is reached. The commitment, as revised by letter dated February 1, 2016, states that, if the corrective actions include a reanalysis of the slip joint repair clamp, the revised analysis will be submitted to the staff for review a minimum of 2 years prior to exceeding 50.7 EFPY. The commitment also references Exelon letters RS-15-232, RS-16-003, and RS-16-033. These letters discuss the assignments within the commitment tracking program to revise procedure LTS-1200-4 and initiate corrective actions in well in advance of exceeding the fluence limit. As discussed in Section 4.2.10.2 above, the staff confirmed the adequacy of the applicant’s activities associated with the commitment to ensure that the limiting fluence value ($1.17x10^{20}$ n/cm^2) for the jet pump slip joint repair clamp is not exceeded. The commitment must be implemented before the plant enters the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address loss of preload for the jet pump slip joint repair clamp, as required by 10 CFR 54.21(d).

4.2.10.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of the loss of preload on the intended function(s) of the jet pump slip joint repair clamp will be adequately managed by license renewal Commitment No. 47 and associated activities for 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).

4.3 Metal Fatigue Analyses

LRA Section 4.3 provides the applicant’s analyses of the following areas related to metal fatigue:

- LRA Section 4.3.1, ASME Section III, Class 1 Fatigue Analyses
- LRA Section 4.3.2, ASME Section III, Class 2 and 3 and ANSI B31.1 Allowable Stress Analyses
- LRA Section 4.3.3, Environmental Fatigue Analyses for RPV and Class 1 Piping
- LRA Section 4.3.4, Reactor Vessel Internals Fatigue Analyses
- LRA Section 4.3.5, High-Energy Line Break (HELB) Analyses Based on Fatigue
- LRA Section 4.3.6, Main Steam Relief Valve Discharge Piping Fatigue Analyses

4.3.1 ASME Section III, Class 1 Fatigue Analyses

4.3.1.1 Summary of Technical Information

LRA Section 4.3.1 states that the RPV and RCPB piping and components were designed in accordance with the ASME Code Section III, Class 1 design requirements. The applicant prepared the fatigue analyses and fatigue exemptions to determine the effects of cyclic loading resulting from changes in system temperature and pressure and for seismic loading cycles, and to demonstrate that the CUF values for the components will not exceed the design limit of 1.0. The LRA states that the analyses have been identified as TLAAs because these fatigue analyses and fatigue exemptions are based on the number of transient occurrences estimated to bound 40 years of plant operation.

LRA Table 4.3.1-1 provides the transients analyzed for the LSCS, Unit 1, RPV and Class 1 RCPB piping systems, and LRA Table 4.3.1-2 provides the transients analyzed for the Unit 2 RPV and Class 1 RCPB piping systems. These LRA tables, in addition to the baselined cumulative cycle occurrences, projected 60-year occurrences, and CLB fatigue design cycle limits, include additional cycles applied to add margin for transients with low rates of past occurrence. LRA Table 4.3.1-3 provides the components with fatigue exemptions. The LRA states that the Fatigue Monitoring program will be used to monitor the transients and to ensure that corrective actions are taken before any design cycle limit is exceeded.

The applicant dispositioned the ASME Section III, Class 1 fatigue analyses in accordance with 10 CFR 54.21(c)(1)(iii) such that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

4.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1 and the TLAAs for the ASME Section III, Class 1 fatigue analyses to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

The staff reviewed the applicant's TLAAs for the ASME Section III, Class 1 fatigue analyses, and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3. These procedures state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the occurrences of critical thermal and pressure transients for the selected Reactor Coolant System (RCS) components.

LRA Section 4.3.1 states that the fatigue analyses and fatigue exemptions for ASME Section III, Class 1 RPV and RCPB piping and components are based on the transients listed in LRA Tables 4.3.1-1 and 4.3.1-2. The LRA states that the Fatigue Monitoring program is credited to monitor the transient cycles and to require corrective action before exceeding the design limits. The staff determined that the enhanced Fatigue Monitoring program ensures that the number of occurrences of transients will not be exceeded during the period of extended operation or that corrective actions are taken. The staff noted that the additional cycles added for margin to the transients is a conservative approach and will provide additional assurance that the design cycle limits will not be exceeded during the period of extended operation. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.22.

Based on its review, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging related to metal fatigue of the ASME Section III, Class 1 RPV and RCPB piping and components will be adequately managed through the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant's Fatigue Monitoring program monitors and tracks the transient cycles assumed in the analysis and requires corrective action before exceeding the number of transient cycles used in the analysis.

4.3.1.3 UFSAR Supplement

LRA Section A.4.3.1 provides the UFSAR supplement, which summarizes the TLAA for ASME Section III, Class 1 fatigue analyses. The staff reviewed LRA Section A.4.3.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the information to be included in the UFSAR supplement should include a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for ASME Section III, Class 1 fatigue analyses, as required by 10 CFR 54.21(d).

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue on the intended functions of the ASME Section III, Class 1 RPV and RCPB piping and components will be adequately managed by the Fatigue Monitoring program for 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).

4.3.2 ASME Section III, Class 2 and 3 and ANSI B31.1 Allowable Stress Analyses

4.3.2.1 Summary of Technical Information

LRA Section 4.3.2 describes the applicant's allowable secondary stress range reduction factor TLAAs for ASME Section III, Class 2 and 3 and American National Standards Institute (ANSI) B31.1 piping. A stress range reduction factor to the allowable stress range is required if the number of equivalent full temperature cycles exceeds 7,000. The applicant stated that these are considered to be implicit fatigue analyses because they are based on cycles anticipated for the life of the component and are, therefore, TLAAs requiring evaluation for the period of extended operation.

The LRA states that portions of certain systems within the scope of license renewal were designed in accordance with ASME Code Section III, Class 2 or 3 or ANSI B31.1 requirements but are attached to ASME Section III, Class 1 piping and are affected by the same thermal and pressure transients as the Class 1 systems. The list of these systems includes: Residual Heat Removal, High Pressure Core Spray, Low Pressure Core Spray, Reactor Core Isolation Cooling (RCIC), Reactor Water Cleanup, Control Rod Drive, Main Steam, Feedwater, and Condenser and Air Removal. The LRA states that the 60-year projections for the transients that affect these systems demonstrate that the total number of cycles will not exceed the total number of design cycles, which was initially used to determine the applicable stress reduction factor. The

LRA states that this ensures that the original stress range reduction factors used for these systems remain applicable and that the TLAAs will remain valid for the period of extended operation.

The LRA also states that the remaining systems that were designed in accordance with ASME Code Section III, Class 2 or 3 or ANSI B31.1 requirements are affected by different thermal and pressure cycles. The list of these systems include portions of the RCIC, Fire Protection, and Diesel Generator and Auxiliaries systems. The LRA states that an operation review was performed for each of these systems to determine the actual cycle occurrences and to project the number of cycles that will occur through the period of extended operation. The LRA states that each of these operational reviews concluded that the total number of projected 60-year cycles will not exceed 7,000 cycles. The LRA states that this ensures that the original stress range reduction factors used for these systems remain applicable and that the TLAAs will remain valid for the period of extended operation.

The applicant dispositioned these TLAAs in accordance with 10 CFR 54.21(c)(1)(i) such that the ASME Section III, Class 2 and 3 and ANSI B31.1 allowable stress calculations will remain valid for the period of extended operation.

4.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2 and the TLAA for portions of the systems within the scope of license renewal that were designed in accordance with ASME Code Section III, Class 2 or 3 or ANSI B31.1 requirements. These components and piping are attached to ASME Section III, Class 1 piping and are affected by the same thermal and pressure transients as those for the Class 1 systems. The staff reviewed the TLAA to verify, in accordance with 10 CFR 54.21(c)(1)(i), that the ASME Section III, Class 2 and 3 and ANSI B31.1 allowable stress calculations will remain valid for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.3.3.1.2.1. These procedures state that the relevant information in the TLAA, operating plant transient history, design basis, and the CLB are reviewed to confirm that the maximum allowable stress range values for the existing fatigue analysis remain valid for the period of extended operation and that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

The staff noted that the LRA did not specify which thermal and pressure cycles affect these systems or the projected 60-year cycle occurrences. However, because the LRA stated that these systems are affected by the same cycles that affect Class 1 piping, the staff reviewed LRA Tables 4.3.1-1 and 4.3.1-2. For both units, the sum of all the projected 60-year cycle occurrences for all the transients that affect Class 1 RPV and RCPB piping and component is less than 7,000 cycles. The staff noted that each of the systems do not experience all the transients listed in LRA Tables 4.3.1-1 and 4.3.1-2; therefore, this summation was conservative and still resulted in a total of less than 7,000 cycles. Therefore, the staff finds it reasonable that the full-range thermal cycle limit of 7,000, used in the applicant design basis fatigue evaluations associated with the ANSI B31.1 and ASME Section III, Class 2 and 3, piping and components, will not be exceeded and includes margin to account for unanticipated transient occurrences during the period of extended operation.

Accordingly, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAAs for the ASME Section III, Class 2 and 3 and ANSI B31.1 piping and components associated with the portions of the Residual Heat Removal, High Pressure Core Spray, Low Pressure Core Spray, RCIC, Reactor Water Cleanup, Control Rod Drive, Main Steam, Feedwater, and Condenser and Air Removal systems, for which the allowable range of secondary stresses depends on the number of assumed thermal cycles, will remain valid for the period of extended operation. Additionally, the applicant's analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the applicant has demonstrated that, for those piping and components subject to the thermal fatigue described above, the cycle limit for full thermal range transients established in the design analyses will not be exceeded. Therefore, the analysis will remain valid for the period of extended operation.

LRA Section 4.3.2 also includes a TLAA for systems that were designed in accordance with ASME Code Section III, Class 2 or 3 or ANSI B31.1 requirements but are affected by different thermal and pressure cycles than those affecting Class 1 piping. The LRA states that an operational review concluded that the total number of cycles projected for 60 years for these systems are significantly less than the full-range thermal cycle limit of 7,000. However, the LRA did not contain enough information regarding the applicable thermal cycles and 60-year projections associated for these systems.

By letter dated July 7, 2015, the staff issued RAI 4.3.2-1, requesting that the applicant provide the ASME Section III, Class 2 or 3 or ANSI B31.1 systems that are affected by different transients than those affecting Class 1 piping. For each of these systems, the staff further requested that the applicant provide the applicable transients assumed in the allowable stress calculations and projected 60-year cycle occurrences and justify that the TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

By letter dated August 6, 2015, the applicant responded to RAI 4.3.2-1. The applicant confirmed that the RCIC, Fire Protection, and Diesel Generator and Auxiliary systems are the systems affected by the different transients and specified which components within the system were analyzed. For the RCIC system, the applicant identified the portions as the piping components between the RCIC turbine and the suppression pool and between the normally closed steam admission valve and the RCIC turbine.

For each of these three systems, the applicant provided the thermal and pressure cycles that affect the components and provided a justification on how it projected the 60-year cycle occurrences through the period of extended operation. For the RCIC system, the applicant projected a total of 938 applicable cycles for LSCS, Unit 1, and 932 applicable cycles for Unit 2. For the Fire Protection system, the applicant projected a total of 1,530 applicable cycles for each of the diesel-driven fire pumps. For the Diesel Generator and Auxiliary system, the applicant projected a total of 1,420 applicable cycles for each of the emergency diesel generators.

The staff finds the applicant's response to RAI 4.3.2-1 acceptable because the applicant (a) listed the specific transients that affect each of the systems, (b) used an adequate, conservative approach to calculating the projected 60-year cycle count for each of the transients, and (c) provided the total projected cycle counts that affect each of the systems. Thus, the staff's concerns in RAI 4.3.2-1 are resolved.

Based on its review, the staff finds it reasonable that the full-range thermal cycle limit of 7,000, used in the applicant design basis fatigue evaluations associated with the ANSI B31.1 and

ASME Section III, Class 2 and 3 piping and components, will not be exceeded and includes margin to account for unanticipated transient occurrences during the period of extended operation.

Accordingly, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAAs for the ASME Section III, Class 2 and 3 and the ANSI B31.1 piping and components associated with the RCIC, Fire Protection, and Diesel Generator and Auxiliary systems, for which the allowable range of secondary stresses depends on the number of assumed thermal cycles, remain valid for the period of extended operation. Additionally, the applicant's analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the applicant has demonstrated that, for those piping and components subject to thermal fatigue described above, the cycle limit for full thermal range transients established in the design analyses will not be exceeded; therefore, the analysis will remain valid for the period of extended operation.

4.3.2.3 UFSAR Supplement

LRA Section A.4.3.2 provides the UFSAR supplement summarizing the TLAA for ANSI B31.1 or ASME Section III, Class 2 and 3 piping and components. The staff reviewed LRA Section A.4.3.2, consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAAs.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for ANSI B31.1 or ASME Section III, Class 2 and 3 piping and components, as required by 10 CFR 54.21(d).

4.3.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAA for ASME Section III, Class 2 and 3 and ANSI B31.1 allowable stress calculations remains valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluations, as required by 10 CFR 54.21(d).

4.3.3 Environmental Fatigue Analyses for RPV and Class 1 Piping

4.3.3.1 Summary of Technical Information

LRA Section 4.3.3 describes the applicant's evaluation of the effects of the reactor coolant environment on component fatigue life for the period of extended operation. The applicant assessed the impact of the reactor coolant environment on a sample of critical components, which include those listed in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," dated February 1995, and any additional plant-specific components considered to be more limiting.

The LRA states that environmental fatigue calculations were prepared for each component location listed in NUREG/CR-6260 for the newer vintage BWR, which is applicable at LSCS. In order to identify any plant-specific locations that are not bounded by the locations identified in NUREG/CR-6260, the LRA states that environmental fatigue calculations were performed for each RPV component location that has a reported CUF. An environmental fatigue analysis was also prepared for each ASME Section III, Class 1 system or group of subsystems that are affected by the same transients that normally contact reactor coolant. The LRA states that these environmental fatigue calculations were prepared for the limiting location of each wetted material type within the component or system that contacts reactor coolant. The applicant stated that the methodology of NUREG/CR-6909, "Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials," dated March 2014, was used to determine applicable values of the environmental fatigue life correction factor (F_{en}) for each material type. These F_{en} values were then used to evaluate the CUFs that include environmentally adjusted cumulative usage factor (CUF_{en}) effects.

LRA Table 4.3.3-1 and 4.3.3-2 provide the environmental fatigue calculation results for the RPV components. LRA Tables 4.3.3-3 and 4.3.3-4 provide the environmental fatigue calculation results for the Class 1 piping systems. These tables include the locations identified in NUREG/CR-6909 for newer vintage BWR plants.

The applicant dispositioned the evaluations associated with EAF on the Class 1 components in accordance with 10 CFR 54.21(c)(1)(iii) such that the effects of EAF on the intended functions will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

4.3.3.2 Staff Evaluation

The staff found that the applicant addressed the effects of the reactor coolant environment on component fatigue life consistent with the guidance in the SRP-LR and the staff's recommendations for resolving Generic Safety Issue No. 190 (GSI-190), "Fatigue Evaluation of Metal Components for 60-Year Plant Life," dated December 10, 1999. The staff also identified that, consistent with Commission Order No. CLI-10-17, dated July 8, 2010, the evaluations associated with the effects of the reactor coolant environment on component fatigue life are not TLAAs in accordance with the definition in 10 CFR 54.3(a) because these evaluations are not in the applicant's CLB. Nevertheless, the applicant has credited its Fatigue Monitoring program to manage the effects of reactor coolant environment on component fatigue life. Therefore, the staff reviewed LRA Section 4.3.3 and the evaluations for EAF to confirm, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of reactor coolant environment on component fatigue life will be adequately managed for the period of extended operation.

The staff reviewed the applicant's EAF evaluations consistent with the review procedures in SRP-LR Section 4.3.3.1.3, which state that the reviewer should confirm that the applicant has addressed the effects of the reactor coolant environment on component fatigue life as AMPs are formulated in support of license renewal.

In its review of LRA Section 4.3.3, the staff noted that the sample of critical components should include the locations identified in NUREG/CR-6260, as a minimum, as well as additional locations based on plant-specific considerations. The LRA states that environmental fatigue calculations were prepared for each of these component locations. The LRA states that, for carbon and low-alloy steels, austenitic stainless steels, and nickel alloys, the methodology in NUREG/CR-6909 was used to determine applicable F_{en} factors and to obtain a CUF_{en}, which included the effects of the reactor water environment.

The LRA states that for Class 1 piping systems, the applicant evaluated the locations within the system(s) or subsystem(s) that are affected by the same transient definitions and selected the location with the highest CUF_{en} value as its limiting location. The applicant stated that it selected limiting locations for each wetted material type for each system. The applicant then compared the fatigue usage values for the limiting piping locations for each system and compared them to the fatigue usage values for the Class 1 valves, pumps, and containment penetrations within the same system. The LRA states that the selected limiting piping location bounded other component locations for each system, with the exception of Feedwater system Class 1 valves. The applicant applied the F_{en} factors to determine the projected 60-year CUF_{en} values. The LRA states that the 60-year CUF_{en} values, as listed in LRA Tables 4.3.3-1 through 4.3.3-4, do not exceed the design Code limit of 1.0. The applicant stated that the limiting piping location that was analyzed for environmental fatigue can represent another component or piping location that is bounded by that limiting location. The LRA states that the bounded location must be affected by the same transients as the analyzed location; must have a lower CUF value than the CUF value of the analyzed location; and must either be made from the same material or, if made of a different material, the bounded material must have a lower F_{en} value than that of the bounding material.

The staff noted that in order to have a meaningful comparison of CUF values to determine the most limiting component (or leading location) by using the highest CUF value, it is important that the CUF values were assessed similarly (e.g., amount of rigor in calculating CUF) and used the same fatigue curves as those in ASME Code, Section III, Appendix I. The staff noted that through the course of plant operation, it is possible that CUF values for specific components were re-evaluated as part of power uprates, generic letters, and bulletins to different editions of ASME Code, Section III and with varying levels of rigor when compared to the fatigue evaluations performed for the plant's original design.

By letter dated July 7, 2015, the staff issued RAI 4.3.3-1, requesting that the applicant confirm that the CUF values that were compared with each other in a given system to identify the location with the highest CUF value were assessed similarly (e.g., amount of rigor in calculating CUF) and used the same fatigue curves to provide a meaningful comparison. The staff also requested that the applicant provide the basis for ranking or comparing the CUF values to one another to provide an appropriate method for screening and determining a leading/limiting location.

By letter dated August 6, 2015, the applicant responded to RAI 4.3.3-1. The response stated that the Class 1 fatigue analyses were performed in accordance with the ASME Code fatigue curves invoked in the applicable Edition and Addenda of the ASME Code listed in the design specifications for the components. The applicant stated that Class 1 piping systems were originally designed in accordance with ASNI B31.7 Class 1 requirements (1969) and that subsequent piping fatigue analyses were prepared in accordance with ASME Code Section III, Subsection NB-3600 requirements. The applicant stated that these two methodologies apply the same rules for determining the effects of cyclic loading. The response further stated that the thermal transients used in the design and fatigue analyses of the Class 1 piping and components are listed in UFSAR Table 3.9-24, which were derived from those established for the RPV. The applicant stated that this shows that the original design fatigue analyses were prepared using the same set of fatigue curves and the same set of design transients.

To determine limiting locations in the Class 1 piping, the applicant stated that initial comparisons of the CUF values were made between locations within the same stress report for a given subsystem, which ensured that the same inputs and methodology were applied to each location.

The applicant stated that the next step was to compare the limiting CUF values of each subsystem to determine the leading location of the overall piping system. The applicant stated that specific locations were reanalyzed as appropriate to account for modifications and power uprates and that the reanalyses were performed in accordance with ASME Code Section III, Class 1 fatigue design requirements. The applicant noted that this ensured that the revised analyses could still be compared to those in the original ASME NB-3600 stress reports. The applicant then determined the limiting locations by identifying the highest CUF values and then by comparing the bounding F_{en} values for each material. A limiting location(s) for the piping system was selected if the location with the highest CUF value also had the highest bounding F_{en} value determined for the system.

The applicant also stated that certain RPV nozzle fatigue analyses were performed in accordance with ASME Code Section III, NB-3200, which results in a more accurate, rigorous analysis. The applicant stated that it selected a limiting location for each wetted material that was evaluated in accordance with ASME Code Section III, NB-3200.

The staff finds it appropriate that the applicant considered the type of fatigue curves and transient inputs in the fatigue analysis comparisons and that it ensured that the same set of fatigue curves and design transients were consistently used. The staff notes that this ensures the ability to compare CUF values for locations on an equivalent basis. The staff also finds reasonable that the applicant identified limiting locations for each wetted material in its fatigue analyses that used a different methodology (ASME Code Section III, NB-3200) than the methodology primarily used in its comparisons. The staff finds the applicant's response acceptable because (a) the applicant provided an adequate basis to ensure that its comparison of locations was performed on an equivalent basis and (b) the applicant used a conservative approach to determine limiting locations by selecting locations that had the highest CUF value and bounding F_{en} values.

LRA Tables 4.3.3-1 and 4.3.3-2 provide the environmental fatigue results for RPVs of the LSCS, Units 1 and 2, respectively. LRA Tables 4.3.3-3 and 4.3.3-4 provide the environmental fatigue results for the Unit 1 and Unit 2 Class 1 piping systems, respectively. The LRA states that the location with the highest CUF value within the stress report for each material is considered limiting. However, the LRA also states that a location may be bounded by a location of a different material if the bounded material has a lower F_{en} value than that of the material of the leading location.

Note 12 in LRA Table 4.3.3-3 states that stainless steel location 376IJ in the N7 Head Spray Nozzle bounds the carbon steel location 10A in the Reactor Core Isolation Cooling piping system for LSCS, Unit 1. The staff also noted that Note 12 in LRA Table 4.3.3-3 states that environmental fatigue analysis for the stainless steel location 376IJ is provided in LRA Table 4.3.3-1. The staff noted that location 376IJ is provided in LRA Table 4.3.3-2, which provides the environmental fatigue analysis results for Unit 2. The staff is unclear on either one of the following: (a) which component in LRA Table 4.3.3-1 the note is referencing or (b) how a component in Unit 2 can bound a piping component in Unit 1 for consideration of EAF.

In addition, in RAI 4.3.3-1, by letter dated July 7, 2015, the staff also requested the applicant to clarify which RPV component bounds the carbon steel location 10A from LRA Table 4.3.3-3. The applicant was also requested to identify any additional locations where a different material type was bounded by the limiting location(s) within a system and provide the system, locations, and materials that have been compared and bounded. For carbon steel location 10A in LRA Table 4.3.3-3 and any additional locations, the applicant was further requested to justify that the comparison of CUF_{en} values between different materials within a RPV component or piping system for the consideration of EAF is appropriate or valid.

In addition, in its response to RAI 4.3.3-1, by letter dated August 6, 2015, the applicant stated that it acknowledged the incorrect bounding location for the carbon steel location 10A and identified another incorrect link from a bounded location to a bounding location in LRA Table 4.3.3-2. The applicant provided the correct location links and updated LRA tables that show the updated locations. The staff reviewed the updated LRA tables and finds the corrections appropriate.

In its response, the applicant confirmed that this carbon steel piping location is bounded by a stainless steel head spray nozzle outer flange component in the RCIC system. The applicant also identified the additional systems where the leading stainless steel location bounds a carbon steel location: the Reactor Recirculation system, the Reactor Water Cleanup system, and the RHR Supply and Return system.

For the RCIC system, the applicant's response states that separate ASME Section III, NB-3600 fatigue analyses were performed for each unit's carbon steel RCIC piping systems. The applicant stated that there was one ASME Section III, NB-3200 analysis that included a finite element model that was common for both units for the stainless steel head spray nozzle outer flange. The carbon steel location, Node 10A, is a piping elbow welded to the stainless steel flange; therefore, both components experience the same set of transients. The applicant applied its methodology to select the limiting location and determined that the stainless steel head spray nozzle outer flange has both a higher CUF value, a higher bounding F_{en} multiplier, and it was performed with a more rigorous fatigue analysis than the carbon steel piping locations. Therefore, the applicant selected the stainless steel flange to bound the carbon steel piping locations for the RCIC system. The applicant applied this methodology to determine the limiting locations for the Reactor Recirculation system, the Reactor Water Cleanup system, and the RHR Supply and Return system. However, the staff noted that the CUF_{en} value of locations made from different materials may respond differently when the EAF is being refined in the future. For the systems that include a limiting location that bounds a location of a differing material, the applicant did not provide sufficient justification that the stainless steel component would continue to be the leading location for components made from carbon steel materials eliminated after the CUF_{en} has been refined for the stainless steel component. The applicant did not justify that the refinement of the higher CUF_{en} of one material would ensure the reduction of CUF_{en} values for another material within the same transient section such that the selected leading location would remain appropriate.

In its response to RAI 4.3.3-1, the applicant provided Tables 1 and 2 (for Units 1 and 2, respectively), which contain the ASME CUF values and bounding F_{en} multiplier factors for stainless steel and carbon steel locations with the highest CUF values. It was not clear to the staff whether the ASME CUF values represented the environmentally adjusted CUF values. The staff also had questions on how the bounding F_{en} factors were calculated, and why these values differed from the F_{en} values provided in LRA Tables 4.3.3-3 and 4.3.3-4.

The applicant's response to RAI 4.3.3-1 also stated that, for LSCS, Unit 1, the reactor recirculation system, RHR supply and return system, and reactor water cleanup system are subjected to similar transients. For LSCS, Unit 2, the applicant stated that the reactor recirculation system and reactor water cleanup system are subjected to a similar set of transients. LRA Section 4.3.3 uses the term "same" when referencing transient sets. The staff was unclear whether the "similar" transients represent the "same" transient set for each system.

The LRA states that the environmental fatigue analyses will be reviewed and updated if necessary to ensure that the limiting locations have been satisfactorily evaluated for reactor water environmental effects. The staff was unclear if the applicant will review the locations initially determined as limiting (locations included in LRA Tables 4.3.3-1 through 4.3.3-4), or if the applicant will re-evaluate the limiting locations using its screening determination to ensure that locations selected are still the most limiting in the system or subsystem. If the applicant will only review the environmental fatigue analyses for the locations in LRA Tables 4.3.3-1 through 4.3.3-4, the staff needed additional justification on how the applicant will ensure that the limiting locations have not changed, especially accounting for systems that include different materials.

By letter dated November 3, 2015, the staff issued follow-up RAI 4.3.3-1a, requesting that the applicant provide justification that the refinement of the leading component material would bound other component materials in the listed systems. The staff requested that the applicant: (a) clarify the information provided in Tables 1 and 2, (b) clarify if "similar" transient sets represent the same set of transients, (c) describe how ASME CUF values were refined to achieve the 60-year NUREG/CR-6909 CUF values represented in the LRA, (d) provide additional justification that the environmental fatigue evaluation of stainless steel components can bound carbon steel components within the same systems, and (e) clarify if the selection of limiting components will be re-evaluated when initiating corrective actions.

By letter dated December 10, 2015, the applicant responded to RAI 4.3.3-1a. In the first part of the response, the applicant clarified that the ASME CUF values provided in Tables 1 and 2 in its response to RAI 4.3.3-1 are not environmentally adjusted CUF values but are the limiting ASME CUF values for the subsystems. Also, for Tables 1 and 2, the applicant provided the assumptions and methodology to calculate the bounding F_{en} multipliers that were used to select the bounding stainless steel locations. For carbon steel and stainless steel, the applicant used applicable sulfur content and/or strain rates that conservatively maximizes the F_{en} values. The applicant also stated that average temperatures were used to calculate F_{en} values, consistent with NUREG/CR-6909. The applicant specified that when calculating average transient temperatures, the higher value between the minimum transient temperature and the threshold temperature was used as a conservative approach. The applicant also provided additional details on its implementation of the equations from NUREG/CR-6909 to calculate the bounding F_{en} multipliers for the stainless steel and carbon steel components listed in Tables 1 and 2. The staff noted that the applicant's methodology, including average temperature calculations, are consistent with the guidance in NUREG/CR-6909. The staff also noted that the applicant provided appropriate clarification regarding the values in Tables 1 and 2 in the response to RAI 4.3.3-1. The staff finds this portion of the applicant's response acceptable.

Also in its response to RAI 4.3.3-1a, the applicant clarified that for Unit 1, the Reactor Recirculation system, RHR Supply and Return system, and Reactor Water Cleanup system are subjected to the same set of design transients and likewise for Unit 2, the Reactor Recirculation system and Reactor Water Cleanup system. The staff noted that this clarification resolves the staff's concern that the same set of design transients were used to compare systems when evaluating fatigue. The staff finds this portion of the applicant's response acceptable.

Also in its response to RAI 4.3.3-1a, the applicant provided additional details on how CLB ASME CUF values, such as those listed in Tables 1 and 2, were refined to achieve the 60-year NUREG/CR-6909 CUF values listed in the LRA. The applicant stated that the 60-year NUREG/CR-6909 CUF values were determined using the NUREG/CR-6909 fatigue curves instead of ASME Code fatigue curves for the applicable materials; using average operating temperature for transients instead of bounding design temperatures, and using reduced numbers of cycles based upon 60-year cycle projections shown in LRA Tables 4.3.1-1 and 4.3.1-2. The staff noted that these refinements provide appropriate and meaningful values when developing the 60-year projected CUF values. The staff finds this portion of the applicant's response acceptable.

To address the staff's concerns associated with bounding a component of one material with a different material within a system, the applicant stated that it performed additional environmental fatigue analyses for the carbon steel locations that were previously stated to be bounded by stainless steel components. The applicant stated that it has now evaluated the bounding location of each material within a system and no longer credits environmental fatigue analyses of stainless steel components to bound carbon steel components. The applicant evaluated the limiting carbon steel location for each of the Unit 1 and Unit 2 Reactor Recirculation system, the RHR Supply and Return system, the Reactor Water Cleanup system, and Reactor Core Isolation Cooling system. The applicant updated LRA Tables 4.3.3-3 and 4.3.3-4 to include these new evaluation results and deleted references in its LRA that state that one material can bound another material for environmental fatigue evaluations. The staff noted that the applicant has performed the environmental fatigue evaluations of the limiting components of each material within a system and no longer uses an environmental fatigue evaluation of one material to bound a differing material. The staff also reviewed the updates to the LRA and noted that it appropriately reflects the applicant's response and new fatigue evaluation results. The staff finds this portion of the applicant's response acceptable.

In its response to RAI 4.3.3-1a, the applicant stated that when initiating corrective actions to review and update environmental fatigue analyses, the applicant will evaluate and update the selection of limiting locations as necessary. The applicant specified that its implementing procedures state that the locations qualified for environmental fatigue must continue to bound the locations that were not evaluated for environmental fatigue. The applicant stated that it updated the LRA, including the description of the Fatigue Monitoring program in the UFSAR supplement to specify that corrective actions will confirm that the locations evaluated for environmental fatigue remain bounding or will evaluate new limiting locations. The staff noted that with this clarification, the applicant will re-evaluate its bounding location selections and ensure that with any changes to environmental fatigue calculations, the applicant will continue to evaluate all limiting locations for environmental fatigue. The staff also noted that the updates to LRA Sections A.3.1.1 and B.3.1.1 accurately reflect the applicant's RAI response. The staff finds this portion of the applicant's response acceptable. The staff's concerns in RAI 4.3.3-1 and RAI 4.3.3-1a are resolved.

LRA Section 4.3.3 states that the environmental fatigue evaluations, shown in LRA Tables 4.3.3-1 through 4.3.3-4, as revised, will be incorporated into the CLB prior to the period of extended operation. The applicant will manage these fatigue evaluations using the Fatigue Monitoring program. The applicant states that this program will ensure that the cumulative number of occurrences of each of the transients will be maintained below the occurrence values used in the environmental fatigue evaluations. The Fatigue Monitoring program will initiate corrective actions when cycle limits are approached. The corrective actions will ensure that the CUF values do not exceed the ASME Code design limit of 1.0, including the effects of the reactor coolant environment. The applicant also clarified that these corrective actions include re-evaluation of bounding location selections as provided in its response to RAI 4.3.3-1a, as described above in this SER section. The staff's evaluation of the Fatigue Monitoring program is provided in SER Section 3.0.3.2.22. The staff noted the applicant enhanced its program to evaluate the effects of the reactor coolant on fatigue evaluations. Therefore, the staff finds the applicant's use of the Fatigue Monitoring program appropriate.

Accordingly, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of environmental fatigue on the intended functions of Class 1 components will be adequately managed for the period of extended operation. Additionally, the applicant's disposition meets the acceptance criteria in SRP-LR Section 4.3.2.1.3 because the applicant has demonstrated that the impact of the environmental fatigue on Class 1 components has been adequately addressed and will be managed by the Fatigue Monitoring Program. Therefore, the applicant's environmental fatigue evaluations will remain valid, and the ASME Code limit of 1.0 will not be exceeded during the period of extended operation, or corrective actions will be taken.

4.3.3.3 UFSAR Supplement

LRA Section A.4.3.3 provides the UFSAR supplement summarizing the environmental fatigue analyses for RPV and Class 1 piping. The staff reviewed LRA Section A.4.3.3, consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA for the RVIs, as required by 10 CFR 54.21(d).

4.3.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has acceptably demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of environmental fatigue on the intended functions of the Class 1 components will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the EAF evaluations, as required by 10 CFR 54.21(d).

4.3.4 Reactor Vessel Internals Fatigue Analyses

4.3.4.1 Summary of Technical Information

LRA Section 4.3.4 states that the RVIs were procured before the issuance of ASME Code Section III, Subsection NG. However, the applicant stated that after the issuance of ASME Code Section III, Subsection NG, the applicant compared its RVI design with the ASME Code to ensure that the equivalent level of safety was met. The LRA states that it identified the RVI components that have been analyzed for fatigue, which are listed in LRA Table 4.3.4-1 along with the corresponding bounding CUF value for both units at 40 years.

The LRA states that the fatigue analyses and fatigue exemptions for these RVI components were identified as TLAAs that are based on the same set of design transients used in the RPV fatigue analyses. The LRA further states that the original analyses were updated to consider the hydrodynamic loading effects resulting from LOCA events (including condensation oscillation and chugging cycles) and main steam relief valve (MSRV) discharge loads.

The applicant dispositioned the TLAA for the RVIs in accordance with 10 CFR 54.21(c)(1)(iii) such that the effects of metal fatigue on the intended functions will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

4.3.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.4 and the metal fatigue TLAAs for the RVI components to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of fatigue will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

The staff reviewed the applicant's metal fatigue TLAAs for the RVI components and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.3.3.1.1.3. These procedures state that the reviewer should verify the appropriateness of the applicant's program for monitoring and tracking the number of occurrences of critical thermal and pressure transients for the selected RCS components.

The staff noted that the transients for the RVI components are those listed in LRA Tables 4.3.1-1 and 4.3.1-2 and will be monitored and tracked by the Fatigue Monitoring program. The staff reviewed LRA Table 4.3.4-1 and (a) noted that the applicant used the bounding CUF value from both units to analyze each RVI component and (b) confirmed that the bounding CUF value is either below the design limit of 1.0 or is exempted in accordance with the criteria of ASME Code Section III, NG-3222.4(d). The staff determined that the enhanced Fatigue Monitoring program is capable of managing metal fatigue during the period of extended operation, consistent with GALL Report X.M1. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.22.

The staff also reviewed its SEs of the power uprates implemented at LSCS. LSCS implemented a stretch power uprate in 2000 and a MUR power uprate in 2010. The staff confirmed that for both uprates, the fatigue design requirements will remain valid following implementation of the power uprates.

Based on its review, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging related to fatigue of the RVI components will be adequately managed for the period of extended operation. Additionally, the applicant's disposition meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because the applicant is crediting its Fatigue Monitoring program to manage metal fatigue to ensure that the allowable design limits on fatigue usage are not exceeded during the period of extended operation; otherwise, the applicant will take corrective actions in accordance with its program.

4.3.4.3 UFSAR Supplement

LRA Section A.4.3.4 provides the UFSAR supplement summarizing the metal fatigue TLAA for the RVI components. The staff reviewed LRA Section A.4.3.4, consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the reviewer verifies that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address metal fatigue TLAA for the RVIs, as required by 10 CFR 54.21(d).

4.3.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the RVI components will be adequately managed by the Fatigue Monitoring program for 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).

4.3.5 High-Energy Line Break Analyses Based on Fatigue

4.3.5.1 Summary of Technical Information

LRA Section 4.3.5 states that the HELB analyses used the CUF values from the ASME Section III, Class 1 fatigue analyses as inputs for determining intermediate break locations. The applicant identified the HELB analyses as TLAAs because the Class 1 fatigue analyses were based on transient cycles postulated to bound 40 years of operation. The LRA states that these transients include 400 Startup and Shutdown cycles and will be monitored by the Fatigue Monitoring program to ensure that the CUF values will not exceed the design limit of 0.1 used in the HELB analyses.

The applicant dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) such that the Fatigue Monitoring program will be used to manage transient cycles as inputs for the HELB analyses.

4.3.5.2 Staff Evaluation

The staff reviewed LRA Section 4.3.5 and the TLAAs for HELB analyses based on a CUF criterion to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging will be adequately managed during the period of extended operation.

The staff reviewed the applicant’s TLAA and the corresponding disposition consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which state that the applicant proposes to manage the aging effects associated with the TLAA by an AMP in the same manner as described in the integrated plant assessment in 10 CFR 54.21(a)(3). The SRP-LR also states that the reviewer reviews the applicant’s AMP to verify that the effects of aging on the intended function(s) are adequately managed consistent with the CLB for the period of extended operation. In addition, SRP-LR requires that a license renewal applicant must identify the structures and components associated with the TLAA.

UFSAR Section 3.6.2 states that high-energy piping are those for which, during “normal plant conditions,” the maximum temperature exceeds 200 °F or the maximum pressure exceeds 275 psig. The staff noted that a given location is identified as a postulated pipe break location if it satisfied the criteria in UFSAR Section 3.6.2.1.1. One such criterion is that any intermediate location between terminal ends where the CUF from the piping fatigue analysis exceeds 0.1 is identified as a line break location. The staff noted that the postulations of break location based on CUFs are TLAAs because they are dependent on an assumed number of cycles expected for the design of the plant.

The applicant credits the Fatigue Monitoring program to manage the HELB analyses through the period of extended operation. The staff noted that as long as the number of occurrences of each transient that occurs at the site remains bounded by the 40-year number of cycles assumed in these analyses, the HELB postulation evaluation remains valid. The staff determined that the enhanced Fatigue Monitoring program ensures that the number of occurrences of each transient will not be exceeded during the period of extended operation or that corrective actions are taken. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.22.

Accordingly, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the HELB analyses based on CUF will be adequately managed through the period of extended operation. Additionally, the applicant's Fatigue Monitoring program meets the acceptance criteria in SRP-LR Section 4.3.2.1.1.3 because it monitors and tracks the transient cycles assumed in the analysis and requires corrective action before exceeding the numbers of cycles for each transient used in the analysis.

4.3.5.3 UFSAR Supplement

LRA Section A.4.3.5 provides the UFSAR supplement, which summarizes the TLAA for HELB analyses based on CUF. The staff reviewed LRA Section A.4.3.4, consistent with the review procedures in SRP-LR-Section 4.3.3.2, which state that the information to be included in the UFSAR supplement should include a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for HELB analyses based on CUF as required by 10 CFR 54.21(d).

4.3.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the HELB analyses will be adequately managed by the Fatigue Monitoring program for 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).

4.3.6 Main Steam Relief Valve Discharge Piping Fatigue Analyses

4.3.6.1 Summary of Technical Information

LRA Section 4.3.6 describes the fatigue analysis performed for the MSRV discharge lines. The LRA states that this system was designed to ASME Code Section III, Class 3 requirements, but the applicant conservatively performed a Class 1 fatigue analysis for the MSRV discharge lines for the portion of the MSRV discharge lines that extend from the drywell floor penetration to the quencher. The applicant stated that the combined stresses and corresponding equivalent stress cycles were inputs into the fatigue usage factors. The LRA states that the input cycles were based on the projected 40-year operation service; therefore, the analysis is identified as a TLAA.

The fatigue analysis for the MSRV discharge line is based on a small break accident (SBA) event, which accounts for the hydrodynamic loadings that can affect the MSRV discharge piping, including MSRV actuations, chugging, and seismic effects. The LRA states that, based on the SBA event evaluation, the fatigue analysis for the MSRV discharge lines assumed

2,800 MSRV actuations and determined the limiting MSRV discharge line CUF value to be 0.616. The LRA states that the cycles assumed in the fatigue analysis were projected to 60 years of operation, as included in LRA Tables 4.3.1-1 and 4.3.1-2. Based on these projections, the applicant concluded that the cycles caused by the SBA event will not exceed the number of cycles assumed in the original 40-year analysis. Therefore, the applicant dispositioned this TLAA in accordance with 10 CFR 54.21(c)(1)(i) such that the MSRV discharge piping analyses will remain valid for the period of extended operation.

4.3.6.2 Staff Evaluation

The staff reviewed LRA Section 4.3.6 and the TLAA for the MSRV discharge piping analyses to verify, in accordance with 10 CFR 54.21(c)(1)(i), that MSRV discharge piping analyses will remain valid for the period of extended operation.

The staff reviewed the applicant's TLAA and the corresponding disposition, consistent with the review procedures in SRP-LR Section 4.3.3.1.1.1, which state that the operating transient experience and a list of the assumed transients used in the existing CUF calculations for the current operating term are reviewed to ensure that the number of assumed transients would not be exceeded during the period of extended operation. The SRP-LR further states that the review should also include an assessment of the TLAA information against the relevant design basis information and CLB information.

The LRA states that the MSRV discharge line fatigue analyses are based on the SBA LOCA event. The applicant stated that its original fatigue analyses considered the hydrodynamic loadings that can affect the MSRV discharge piping, including MSRV actuations, chugging, and seismic effects. The LRA states that this evaluation resulted in the original fatigue analyses for the MSRV discharge lines to assume 2,800 MSRV actuations. The staff reviewed LRA Tables 4.3.1-1 and 4.3.1-2 and confirmed that the applicant appropriately baselined the actual transient cycle count of the MSRV actuations for both units and projected the 60-year cycle count. For LSCS, Unit 1, MSRV actuations, the staff noted that the applicant projected a total of 841 cycles at the end of 60 years of operation but still added a margin of 1,159 cycles. For Unit 2 MSRV actuations, the staff noted that the applicant projected a total of 688 cycles at the end of 60 years of operation but still added a margin of 1,312 cycles. The staff noted that the applicant chose to add a conservative margin to project the 60-year cycle counts for the transient. Even with the added margin, the total projected number of occurrences at the end of the period of extended operation would remain below the assumed analysis input of 2,800 cycles. Therefore, the staff finds it reasonable that the input of 2,800 MSRV actuation cycles assumed in the original fatigue analyses will not be exceeded and includes additional margin to account for unanticipated transient occurrences during the period of extended operation.

Accordingly, the staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAAs for the MSRV discharge piping fatigue analyses will remain valid for the period of extended operation. Additionally, the applicant's analysis meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the applicant has demonstrated that, for those limiting MSRV discharge lines, the cycle limit for fatigue analyses established in the design analyses will not be exceeded; therefore, the analysis will remain valid for the period of extended operation.

4.3.6.3 UFSAR Supplement

LRA Section A.4.3.6 provides the UFSAR supplement, which summarizes the TLAA for the MSRV discharge piping fatigue analyses. The staff reviewed LRA Section A.4.3.6, consistent with the review procedures in SRP-LR Section 4.3.3.2, which state that the information to be included in the UFSAR supplement should include a summary description of the evaluation of the TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.3.2.2. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for the MSRV discharge piping fatigue analyses as required by 10 CFR 54.21(d).

4.3.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAA for the MSRV discharge piping fatigue analyses remains valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluations, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification (EQ) of Electric Components

The 10 CFR 50.49 EQ program is a TLAA for purposes of license renewal. The TLAA of the EQ electrical components includes all long-lived, passive, and active electrical and instrumentation and control (I&C) components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas subject to the environmental effects of a design basis event (e.g., LOCAs or HELBs or post-LOCA environment). EQ equipment comprises electrical equipment important to safety (i.e., safety-related and nonsafety-related equipment) that is relied upon to remain functional during and following design basis events including nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent the satisfactory accomplishment of a safety-related function, and certain post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs in the LRA. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4 describes the applicant’s TLAA for the “Environmental Qualification (EQ) of Electric Components.” The TLAA states that the aging evaluations for electrical components in the applicant’s EQ program that specify a qualification of at least 40 years are TLAAs for license renewal because the criteria contained in 10 CFR 54.3 are met. The LRA states that the EQ program meets the requirements of 10 CFR 50.49 for the applicable electrical components important to safety. The LRA also states that the EQ program demonstrates that certain electrical components located in harsh environments are qualified to perform their safety function in those harsh environments after the effects of inservice aging. As stated in the LRA, a harsh environment is an area of the plant that could be subject to the harsh environmental effects of a LOCA, HELB, or post-LOCA radiation. The LRA further states that the EQ program also requires that significant aging mechanisms (e.g., thermal, radiation, and cyclical aging as applicable) be addressed as part of environmental qualification. According to the applicant's EQ program, as required by 10 CFR 50.49, EQ components are refurbished or replaced, or their qualification is extended before they reach the aging limits established in the evaluation. Further, the LRA notes that the reanalysis of an aging evaluation addresses the attributes of analytical methods, data reduction and collection methods, underlying assumptions, acceptance criteria, and corrective actions. The EQ program is stated to manage these aging mechanisms with evaluations based on 10 CFR 50.49 qualification methods. The applicant, in accordance with 10 CFR 54.21(c)(2), performed a review for applicable exemptions to TLAAs and noted that no exemptions were identified based on a TLAA.

The applicant dispositioned the TLAA for the EQ program in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of inservice aging on the intended functions will be adequately managed by the Environmental Qualification (EQ) of Electric Components program for the period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed the applicant's "Environmental Qualification (EQ) of Electric Components" TLAA for electric components and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.4.2.1, which state that, pursuant to 10 CFR 54.21(c)(1)(iii), an applicant must demonstrate that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The EQ requirements established by Criterion 4, "Environmental and Dynamic Effects Design Bases," of Appendix A to 10 CFR Part 50 and by 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. An EQ program in accordance with the requirements of 10 CFR 50.49 is considered an adequate AMP for the purposes of license renewal. Electric components in the applicant's EQ program identified as having a qualified life equal to, or greater than, the current operating term (i.e., 40 years) are considered a TLAA for license renewal. The Environmental Qualification (EQ) of Electric Components program includes long-lived passive and active electrical and I&C components that are important to safety and are located in a harsh environment. Harsh environments are those areas of the plant subject to the environmental effects of a design basis event (e.g., LOCA, an HELB, or post-LOCA environment). EQ equipment comprises electrical equipment important to safety (i.e., safety-related and nonsafety-related equipment) that is relied upon to remain functional during and following design basis events including nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent the satisfactory accomplishment of a safety-related function, and certain post-accident monitoring equipment.

The staff reviewed LRA Sections 4.4 and B.3.1.3, plant basis documents, and additional information provided to the staff and interviewed plant personnel to verify whether the applicant provided adequate information to meet the requirement of 10 CFR 54.21(c)(1). For electrical equipment, the applicant uses 10 CFR 54.21(c)(1)(iii) in its "Environmental Qualification (EQ) of Electric Components" TLAA evaluation to demonstrate that EQ equipment aging mechanisms and effects will be adequately managed during the period of extended operation. In accordance with the GALL Report, plant EQ programs that implement the requirements of 10 CFR 50.49 are considered acceptable AMPs under license renewal 10 CFR 54.21(c)(1)(iii). GALL Report

AMP X.E1, “Environmental Qualification (EQ) of Electric Components,” meets the requirements of 10 CFR 54.21(c)(1)(iii). The staff reviewed the applicant’s “Environmental Qualification (EQ) of Electric Components” program to determine whether the electrical and I&C components covered under this program will continue to perform their intended functions, consistent with the CLB, for the period of extended operation.

The staff’s evaluation of the components qualification focused on how the “Environmental Qualification (EQ) of Electric Components” TLAA and the Environmental Qualification (EQ) of Electric Components AMP manages aging effects to meet the requirements pursuant to 10 CFR 50.49. The staff conducted an audit of the information provided in LRA Sections 4.4, A.4.4, B.3.1.3, and A.3.1.3 and program basis documents, including the aging management review of electrical systems, AMP evaluation results, and operating experience reviews. LRA Section 4.4 evaluates the component reanalysis attributes, including analytical models, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions referenced in SRP-LR Table 4.4-1 against the applicant’s EQ program. On the basis of its audit, the staff concluded that the Environmental Qualification (EQ) of Electric Components AMP, which the applicant claimed to be consistent with GALL Report AMP X.E1, “Environment Qualification (EQ) of Electric Components,” is consistent with the GALL Report. The staff also concluded that the applicant’s EQ program reanalysis attributes TLAA evaluation is consistent with SRP-LR Section 4.4.2.1.3 and SRP-LR Table 4.4-1. Additionally, the staff’s review for applicable exemptions to TLAAs during the audit noted that no exemptions were identified based on a TLAA.

The staff concludes that the applicant’s “Environmental Qualification (EQ) of Electric Components” TLAA meets the acceptance criteria in SRP-LR Section 4.4.2.1 and the specific acceptance criteria of SRP-LR Section 4.4.2.1.3 because the TLAA demonstrates that the applicant’s EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The continued implementation of the EQ program provides assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation.

The staff also finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclical aging on the intended functions of EQ electrical components will be adequately managed for the period of extended operation.

Additionally, the “Environmental Qualification (EQ) of Electric Components” program meets the acceptance criteria in SRP-LR Section 4.4.2.1.3 because the continued implementation of the EQ program provides assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation in accordance with the requirements of 10 CFR 50.49 and 10 CFR 54.21(c)(1)(iii).

4.4.3 UFSAR Supplement

LRA Section A.4.4 provides the UFSAR supplement summarizing the “Environmental Qualification (EQ) of Electric Components” TLAA. The staff reviewed LRA Section A.4.4, consistent with the review procedures in SRP-LR Section 4.4.3.2, which state that the applicant has provided information to be included in the UFSAR supplement that includes a summary description of the TLAA evaluation of the environmental qualification of electric equipment and has provided a UFSAR supplement with information equivalent to that in SRP-LR Table 4.4-2.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.4.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the "Environmental Qualification (EQ) of Electric Components" TLAA, as required by 10 CFR 54.21(d).

4.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of thermal, radiation, and cyclic aging on the intended functions of EQ electrical components will be adequately managed by the "Environmental Qualification (EQ) of Electric Components" program for 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).

4.5 Concrete Containment Tendon Prestress Analyses

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 describes the applicant's TLAA for the concrete containment tendon prestress analyses. The LRA states that the BWR Mark II post-tensioned concrete containment structures at LSCS, Units 1 and 2, consist of a steel head and a post-tensioned wall supported on a basemat of reinforced concrete. The LRA also states that the containment wall post-tensioning system, which extends from the basemat to the refuel floor, consists of 188 horizontal (hoop) and 120 vertical unbonded tendons. Each tendon consists of 90 high strength steel wires within steel conduits filled with a corrosion protection medium.

The LRA states that the containment tendon prestressing forces are subject to time-dependent losses due to relaxation of the steel tendons and to creep and shrinkage of the concrete, which were considered in the original design of the plant to arrive at minimum required values (MRVs) for each tendon type (vertical or hoop) based on a 40-year operating term. The LRA also states that the ASME Section XI, Subsection IWL program (LRA Section B.2.1.30) conducts periodic surveillances in which individual tendon prestressing forces are measured and plotted and trend lines are developed. These are evaluated against acceptance criteria in ASME Code Section XI, Subsection IWL, that are based on predicted lower limit (PLL) force values for each sampled tendon at the time of surveillance, calculated in accordance with RG 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments," dated July 1990, and MRVs for each tendon type. The LRA further states that calculated PLL values and updated trend lines developed based on regression analyses of all actual measured individual tendon forces consistent with NRC Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," dated April 13, 1999, are used to evaluate the acceptability of the containment structure to perform its intended function over the current 40-year life of the plant and, therefore, are TLAAs requiring evaluation for the period of extended operation.

The applicant stated that the regression analyses of all measured forces in individual tendons from surveillances to date, associated with the vertical and hoop tendons at LSCS, Units 1 and 2, updated and projected to 60 years (LRA Figures 4.5.1-1 through 4.5.1-4), indicate a trend that the prestressing forces will remain above the respective group MRVs through the period of extended operation for each tendon group. The applicant stated that the trend lines are updated at each surveillance to demonstrate that the individual and tendon group prestressing forces will remain above the MRV for each tendon type until the next scheduled surveillance and for the life of the plant.

The applicant dispositioned the TLAA for the concrete containment tendon prestress analyses in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of loss of prestress forces on the intended functions of containment will be adequately managed by the Concrete Containment Tendon Prestress program in LRA Section B.3.1.2 for the period of extended operation.

4.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the concrete containment tendon prestress analyses and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.5.3.1.3, which state that the applicant may reference the applicable GALL Report program and that the reviewer verifies that the applicant has identified the appropriate program (i.e., GALL Report AMP X.S1, "Concrete Containment Tendon Prestress") as described and evaluated in the GALL Report. The SRP-LR also states that the reviewer ensures that the applicant has stated that its program contains the same program elements that the staff evaluated and relied on in approving the corresponding generic program in the GALL Report.

Further, the SRP-LR states that the GALL Report recommends further evaluation of the applicant's operating experience related to the containment prestress force to ensure that the applicant's program adequately incorporates the relevant operating experience that occurred at the applicant's plant, as well as at other plants. The SRP-LR also states that the applicant should consider, in its AMP, applicable portions of the operating experience with prestressing systems described in IN 99-10.

The staff reviewed LRA Section 4.5 and verified that the applicant's containment tendon surveillance program, in accordance with ASME Code Section XI, Subsection IWL, develops the PLL force values for each individual tendon scheduled for examination for the given surveillance year, consistent with the guidance in RG 1.35.1. The staff also verified that the applicant's program develops trend lines of prestressing forces for each tendon type or group using actual individual prestressing forces measured during surveillances to date, which is consistent with the guidance provided in IN 99-10. The applicant's acceptance criteria for prestressing forces consists of PLLs and MRVs in accordance with ASME Code Section XI, Subsection IWL. The staff noted that the applicant's updated regression analyses of measured tendon forces for vertical and hoop tendons, based on surveillances at years 1, 3, 5, 10, 15, and 25 for LSCS, Unit 1, and surveillances at years 1, 3, 5, 15, and 25 for LSCS, Unit 2, projected to 60 years (LRA Figures 4.5.1-1 through 4.5.1-4) indicate a trend that the prestressing forces will remain above the MRV for each tendon group through the period of extended operation. Further, the staff noted that, because tendon force trends may vary with time, the applicant plans to use its enhanced Concrete Containment Tendon Prestress AMP, described in LRA Section B.3.1.2, to monitor and manage the TLAAs (PLLs and regression analysis) associated with the loss of tendon prestressing forces during the period of extended operation. The staff noted that, as an enhancement to the LRA program, the trend lines will be updated as part of the regression analyses following each surveillance interval during the period of extended operation and will be compared to the PLL and MRV for each tendon group; appropriate corrective action will be taken if adverse trends are indicated.

The staff's review and evaluation of the LRA Section B.3.1.2 AMP, "Concrete Containment Tendon Prestress," which, with enhancement, will be consistent with the 10 elements of the GALL Report AMP X.S1, "Concrete Containment Tendon Prestress," is documented in SER Section 3.0.3.2.23. This review includes further evaluation of the applicant's operating experience related to the containment prestress forces, and the results show that the applicant's program has adequately considered plant-specific and industry operating experience.

Accordingly, the staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of tendon prestressing forces on the intended functions of concrete containment structures will be adequately managed by the Concrete Containment Tendon Prestress AMP for the period of extended operation.

Additionally, the applicant's program meets the acceptance criteria in SRP-LR Section 4.5.2.1.3 because (1) the applicant has identified the Concrete Containment Tendon Prestress program that assesses containment tendon prestressing forces, which, with an enhancement, will be consistent with the 10 elements of the GALL Report AMP X.S1, determined by staff as an acceptable AMP to address containment tendon prestress pursuant to 10 CFR 54.21(c)(1)(iii), and (2) the applicant's program adequately considered plant-specific and industry operating experience related to the containment prestress forces.

4.5.3 UFSAR Supplement

LRA Section A.4.5 provides the UFSAR supplement summarizing the TLAA related to concrete containment tendon prestress analyses. The staff reviewed LRA Section A.4.5, consistent with the review procedures in SRP-LR Section 4.5.3.2, which state that the reviewer verifies that the applicant has provided an UFSAR supplement that includes a summary description of the evaluation of tendon prestress TLAA with information equivalent to that in SRP-LR Table 4.5-1.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.5.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address concrete containment tendon prestress analyses TLAA, as required by 10 CFR 54.21(d).

4.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of loss of tendon prestressing forces on the intended functions of concrete containment structures will be adequately managed by the Concrete Containment Tendon Prestress AMP for 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).

4.6 Primary Containment Fatigue Analyses

LRA Section 4.6 provides the applicant's analyses of the following areas related to primary containment fatigue:

- LRA Section 4.6.1, Primary Containment Liner and Penetrations Fatigue Analyses
- LRA Section 4.6.2, Primary Containment Refueling Bellows Fatigue Analysis
- LRA Section 4.6.3, Primary Containment Downcomer Vents Fatigue Analysis

4.6.1 Primary Containment Liner and Penetrations Fatigue Analyses

4.6.1.1 Summary of Technical Information in the Application

LRA Section 4.6.1 describes the applicant's TLAAs for primary containment liner, Class MC components, and penetrations that were designed and analyzed for transient cycles predicted for 40 years. The containment liner and Class MC components are non-Class 1 components designed for cumulative fatigue damage in accordance with ASME Code Section III, Subsection NE-3222.4, based on the transient cycles listed in LSCS UFSAR Table 5.2-4. In the same manner, the fatigue analyses for the primary containment penetrations are performed in accordance with ASME Code Section III, Subsections NB-3222 and NE-3223, for Class 1 penetrations and in accordance with ASME Code Section III, Subsection NB-3222.4 for non-Class 1 (Class MC) penetrations. The applicant considers Class 1 penetrations to be those penetration assemblies with Type I head fittings and penetration sleeves and non-Class 1 or Class MC as those penetration assemblies with Type II and III head fittings and penetration sleeves. The applicant also considers Class MC components to be those steel components from the concrete containment that form part of the pressure boundary and are not backed by structural concrete (e.g., drywell head assembly and equipment hatch).

LRA Tables 4.3.1-1 and 4.3.1-2 shows the results of 60-year transient cycles projections for LSCS, Units 1 and 2, respectively. These transient cycle projections include 21 normal, upset, and test conditions and 8 emergency and faulted conditions. The applicant stated that the results for Unit 1 (LRA Table 4.3.1-1) show that transient cycle projections for startup and shutdown conditions, transient numbers 3 and 13, are projected to exceed their design limits within 60 years. The applicant also stated that the results for Unit 2 (LRA Table 4.3.1-2) demonstrate that transient cycle limits for Class 1 piping penetrations and the containment liner will not be exceeded in 60 years. The applicant further stated that the Fatigue Monitoring program (LRA Section B.3.1.1) will be used to monitor and track the analyzed transients and to provide corrective actions before exceeding the transient cycle limits to ensure that the component CUF does not exceed the design limit of 1.0 for these components.

The applicant dispositioned the TLAAs for the primary containment liner, Class MC components, and penetrations in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate that the effects of cumulative fatigue damage on the intended functions of components analyzed in accordance with ASME Code Section III, Class 1 requirements will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed the applicant's TLAAs for the primary containment liner, Class MC components, and penetrations and their corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.3, which state that the program shall demonstrate that the effects of aging on the component's intended function(s) will be adequately managed during the period of extended operation. The SRP-LR also states that, if the program relies on mitigation or inspection, it shall be reviewed against the 10 elements described in SRP-LR Section A.1 "Aging Management Review-Generic (Branch Technical Position RLSB-1)." If the applicant proposes a component replacement before its CUF exceeds 1.0, the CUF for the replacement must be less than or equal to 1.0 during the period of extended operation.

In its review of the applicant's TLAA disposition in LRA Section 4.6.1, the staff noted that the disposition specifically addresses components that are in accordance with ASME Code Section III, Class 1 requirements, but it does not address non-Class 1 components. The LRA does not state how the TLAA analyses associated with non-Class 1 components were dispositioned in the application or how the effects of aging for these components will be adequately managed to ensure that the CUF values are maintained less than or equal to 1.0 during the period of extended operation. The staff also noted that the application does not specify which transient cycle projections from LRA Tables 4.3.1-1 and 4.3.1-2 correspond to each fatigue analysis described in LRA Section 4.6.1. By letter dated August 28, 2015, the staff issued RAI 4.6.1-1, requesting that the applicant clarify which transient cycle projection(s) from LRA Tables 4.3.1-1 and 4.3.1-2 was considered for each design analysis described in LRA Section 4.6.1, clarify the TLAA dispositions for non-Class 1 components, and describe how the transient limits will be maintained below the design limits for these components.

In its response dated September 28, 2015, the applicant stated that the design analyses described in LRA Section 4.6.1 are associated with the transient cycle projections from LRA Tables 4.3.1-1 and 4.3.1-2 as follows:

- For primary containment liner plates and Class MC components, the applicant stated that transient numbers 21 and 28 were projected for 60 years and are monitored by the Fatigue Monitoring program.
- For containment penetration assemblies that contain Class 1 process pipe or head fittings, the applicant stated that transient numbers 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9a, 9b, 9c, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, and 28 were projected for 60 years and are monitored by the Fatigue Monitoring program.
- For containment penetration assemblies that contain non-Class 1 process pipe with maximum operating temperatures greater than 220 °F (including head fitting and penetration sleeves), the applicant stated that transient numbers 1, 3, 4, 9a, 9b, 10, 11, 13, 15, 16, 17, 22, 23, 24, 27, and 28 were projected for 60 years and are monitored by the Fatigue Monitoring program.
- For containment penetration assemblies that contain non-Class 1 process pipe with maximum operating temperatures equal to or less than 220 °F (including head fitting and penetration sleeves), the applicant stated that most of the analyses are based on the same transients listed for those penetrations with maximum operating temperatures greater than 220 °F (above) and they are monitored by the Fatigue Monitoring program. The applicant also stated that these analyses were designed in the same manner as those with maximum operating temperatures greater than 220 °F.

In its response, the applicant also stated that there are some primary containment penetration assemblies that contain non-Class 1 piping that were analyzed for transients that are not included in LRA Tables 4.3.1-1 and 4.3.1-2. The applicant addressed these additional transients as follows:

- For containment penetration M-76, the applicant stated that the penetration contains the RCIC turbine exhaust line to the suppression pool for which the associated fatigue analysis is based on the RCIC injections cycles listed in LRA Tables 4.3.1-1 and 4.3.1-2, transient numbers 9b and 17, and other surveillance testing cycles not included in the LRA tables. The applicant also stated that this analysis was re-evaluated based on 60-year projection cycles for transient numbers 9b and 17, plus the predicted RCIC turbine surveillance tests for 60 years (300), and including a margin of 47, which resulted in a total of 600 cycles, with a 60-year CUF value of 0.00235. The applicant further stated that the allowable number of cycles for these transients is approximately 255,000 cycles.

- Using containment penetrations M-83, M-88, M-89, and M-99 as a representative sample, the applicant stated that the fatigue analyses are based on transients that are associated with potential discharges from relief valves that are not included in the LRA tables. The applicant also stated that current CUF values are 0.000005 for containment penetration M-83 and 0.000038 for containment penetrations M-88, M-89, and M-99, with an allowable number of cycles of approximately 52,750 cycles for these transients.
- Using containment penetrations M-85, M-86, and M-87 as a representative sample, the applicant stated that the fatigue analyses are based on transients that are associated with potential discharges from safety valves that are not provided in the LRA tables. The applicant also stated that the CUF from current analyses is 0.000004, with an allowable number of cycles of approximately 475,000 cycles for these transients.

The applicant clarified the TLAA dispositions for non-Class 1 components as follows:

- For primary containment Class 1 and non-Class 1 components (for containment liner, MC components, and penetrations) that are analyzed for fatigue based on transient cycles listed in LRA Tables 4.3.1-1 and 4.3.1-2, the applicant stated that they are dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) because the effects of aging will be adequately managed by the Fatigue Monitoring program.
- For primary containment non-Class 1 penetration fatigue analyses that are based on transient cycles not listed in LRA Tables 4.3.1-1 and 4.3.1-2, the applicant stated that they are dispositioned in accordance with 10 CFR 54.21(c)(1)(i); the analyses remain valid through the period of extended operation because they have low CUF values and a high number of allowable cycles that will not be exceeded during the period of extended operation.
- For primary containment penetration M-76, the applicant stated that the non-Class 1 RCIC turbine exhaust line is dispositioned in accordance with 10 CFR 54.21(c)(1)(ii) because the analysis has been projected through the period of extended operation.

As a part of this RAI response, the applicant revised LRA Section 4.6.1 and Appendix A.4.6.1.

The staff finds the applicant's response acceptable because the applicant (1) stated the transient cycle projections from LRA Tables 4.3.1-1 and 4.3.1-2 that correspond to each design analysis described in LRA Section 4.6.1, (2) clarified that the TLAA disposition in accordance with 10 CFR 54.21(c)(1)(iii) addresses Class 1 and non-Class 1 components for the primary containment liner, Class MC components, and penetrations to ensure that transient limits will be maintained below the design limits during the period of extended operation, and (3) evaluated other transients not listed in the LRA tables in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) in a manner that is consistent with the review procedures in SRP-LR Sections 4.6.2.1.1.1 and 4.6.2.1.1.2, respectively. Thus, the staff's concern described in RAI 4.6.1-1 is resolved.

Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of Class 1 and non-Class 1 components for the primary containment liner, Class MC components, and penetrations will be adequately managed for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.3 because the Fatigue Monitoring program is a preventive program that will ensure that the CUF is not permitted to exceed the design limit of 1.0 for these components by analyzing transients and by initiating corrective action before exceeding the transient limits.

The staff also reviewed the applicant's TLAA for the primary containment non-Class 1 penetrations that are based on transient cycles not listed in LRA Tables 4.3.1-1 and 4.3.1-2 and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.1, which state that the number of assumed transients used in the existing CUF calculations for the current operating term needs to be compared to the extrapolation to 60 years of operation of the number of operating transients experienced to date, and this comparison must confirm that the number of transients in the existing analyses will not be exceeded during the period of extended operation. Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses for the primary containment non-Class 1 penetrations that are based on transients cycles not listed in LRA Tables 4.3.1-1 and 4.3.1-2 will remain valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of assumed cyclic loads will not be exceeded during the period of extended operation, considering the very low CUF values and high number of allowable cycles provided by the analyses for these components.

The staff also reviewed the applicant's TLAA for the primary containment non-Class 1 penetration M-76 and the corresponding disposition of 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.2, which state that the revised CUF calculations based on the projected number of assumed cyclic loads are reviewed to ensure that the CUF remains less than 1.0 at the end of the period of extended operation. Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the fatigue analysis for the primary containment non-Class 1 penetration M-76 has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.2 because the revised analysis shows that the 60-year CUF value of 0.00235 does not exceed 1.0, as required by the ASME Code, for the period of extended operation.

4.6.1.3 UFSAR Supplement

LRA Section A.4.6.1, as amended, provides the UFSAR supplement summarizing the applicant's TLAAs for primary containment liner, Class MC components, and penetrations that were designed and analyzed for transient cycles predicted for 40 years. The staff reviewed LRA Section A.4.6.1 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided a UFSAR supplement that includes information equivalent to that in SRP-LR Table 4.6-1 and a summary description of the evaluation of each fatigue analysis TLAA.

Based on its review of the UFSAR supplement, as amended by letter dated September 28, 2015, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.6.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address primary containment liner, Class MC components, and penetrations fatigue analyses, as required by 10 CFR 54.21(d).

4.6.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cumulative fatigue damage on the intended functions of Class 1 and non-Class 1 components from the primary containment liner, Class MC components, and penetrations will be adequately managed by the Fatigue Monitoring program (LRA Section B.3.1.1) for the period of extended operation. The staff also concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analyses for the primary containment non-Class 1 penetrations that are based on transients cycles not listed in the LRA Tables 4.3.1-1 and 4.3.1-2 remain valid for 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 fatigue analysis for the primary containment non-Class 1 penetration M-76 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).

4.6.2 Primary Containment Refueling Bellows Fatigue Analysis

4.6.2.1 Summary of Technical Information in the Application

LRA Section 4.6.2 describes the applicant’s TLAA for the primary containment refueling bellows that were designed and analyzed for transient cycles predicted for 40 years of operation. The applicant stated that the metal refueling bellows provides a flexible seal to prevent water leakage from the LSCS, Units 1 and 2, reactor cavity refueling pool into the drywell during refueling operations. The applicant further stated that the refueling bellows were analyzed for 200 startup/shutdown cycles, 200 normal operation cycles, 123 refueling (boltup/unbolt) cycles, 1 normal seismic event, and 1 refueling seismic event with a total CUF of 0.158 for the refueling bellows. Because the analyzed 60-year transient cycle projections (LRA Tables 4.3.1-1 and 4.3.1-2) will not exceed the numbers of cycles analyzed for the refueling bellows, the applicant concluded that the analysis remains valid through the period of extended operation.

The applicant dispositioned the TLAA for the metal refueling bellows in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.6.2.2 Staff Evaluation

The staff reviewed the applicant’s TLAA for the primary containment refueling bellows and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.1, which state that the number of assumed transients used in the existing CUF calculations for the current operating term needs to be compared to the extrapolation to 60 years of operation of the number of operating transients experienced to date, and this comparison must confirm that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

In its review, the staff noted that both units have projected 123 boltup/unbolt cycles, which do not exceed the 123 refueling (boltup/unbolt) cycles used in the transient analysis for the refueling bellows. The staff also noted that the other projected 60-year cycles associated with the refueling bellows do not exceed the analyzed cycles.

Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the fatigue analysis for the primary containment refueling bellows remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of assumed transients cycles in the existing fatigue analysis of the refueling bellows will not be exceeded during the period of extended operation.

4.6.2.3 UFSAR Supplement

LRA Section A.4.6.2 provides the UFSAR supplement summarizing the TLAA for cumulative fatigue analysis of the primary containment refueling bellows. The staff reviewed LRA Section A.4.6.2, consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided a UFSAR supplement with information equivalent to that in SRP-LR Table 4.6–1, and that includes a summary description of the evaluation of each fatigue analysis TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SR-LR Section 4.6.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for cumulative fatigue analysis of the primary containment refueling bellows, as required by 10 CFR 54.21(d).

4.6.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the primary containment refueling bellows remains valid for 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).

4.6.3 Primary Containment Downcomer Vents Fatigue Analysis

4.6.3.1 Summary of Technical Information in the Application

LRA Section 4.6.3 describes the applicant’s TLAA for the primary containment downcomer vents that were designed and analyzed for transient cycles predicted for 40 years of operation. The applicant stated that the 98 primary containment downcomer vent pipes transport steam and non-condensable gases to the suppression pool from the reactor and the drywell during LOCA conditions. The applicant also stated that there are three locations of discontinuity on the downcomers that govern for fatigue: (1) drywell floor anchor, (2) upper bracing attachment location, and (3) lower bracing attachment location. The applicant further stated that combined stresses and corresponding equivalent stress cycles were analyzed for a 40-year plant life to obtain the fatigue usage factors by considering the following three subevents: (1) one SBA LOCA (producing chugging loads) with a safe-shutdown earthquake (SSE), (2) five isolation events (cyclic MSRV actuation), each with one coincident operating basis earthquake (OBE), and (3) remaining MSRV actuations (including 163 isolation events). LRA Tables 4.3.1-1 and 4.3.1-2 show the applicant’s 60-year transient cycle projections for the MSRV actuations, OBE events, and SSE events for LSCS, Units 1 and 2, respectively. Because the analyzed 60-year transient cycle projections will not exceed the number of transient cycles analyzed for the primary containment downcomers vents, the applicant concluded that the analysis remains valid through the period of extended operation.

The applicant dispositioned the TLAA for the primary containment downcomer vent pipes in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.6.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the primary containment downcomer vent pipes and the corresponding disposition of 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.6.3.1.1.1, which state that the number of assumed transients used in the existing CUF calculations for the current operating term needs to be compared to the extrapolation to 60 years of operation of the number of operating transients experienced to date, and this comparison must confirm that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

In its review, the staff noted that the 60-year projected number of transient cycles for MSRV actuations from LRA Tables 4.3.1-1 and 4.3.1-2 does not exceed the 2,788 cycles evaluated by the current transient analysis. The staff also noted that the 60-year projected OBE and SSE events do not exceed the analyzed cycle of one event for the primary containment downcomer vents for either unit.

Based on its review, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the primary containment downcomer vent pipes remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.2.1.1.1 because the number of assumed transient cycles in the existing fatigue analysis of the downcomer vents will not be exceeded during the period of extended operation.

4.6.3.3 UFSAR Supplement

LRA Section A.4.6.3 provides the UFSAR supplement summarizing the TLAA for cumulative fatigue analysis of the primary containment downcomer vents and bracing. The staff reviewed LRA Section A.4.6.3 consistent with the review procedures in SRP-LR Section 4.6.3.2, which state that the staff verifies that the applicant has provided an FSAR supplement with information equivalent to that in SRP-LR Table 4.6-1 and that includes a summary description of the evaluation of each fatigue analysis TLAA.

Based on its review of the UFSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.6.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the TLAA for cumulative fatigue analysis of the primary containment downcomer vents and bracing, as required by 10 CFR 54.21(d).

4.6.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the primary containment downcomer vents remains valid for 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).

4.7 Other Plant-Specific Time-Limited Aging Analyses

LRA Section 4.7 summarizes the evaluation of the following plant-specific TLAAs:

- LRA Section 4.7.1, Reactor Building Crane Cyclic Loading Analysis
- LRA Section 4.7.2, Main Steam Line Flow Restrictors Erosion Analysis

4.7.1 Reactor Building Crane Cyclic Loading Analysis

4.7.1.1 Summary of Technical Information in the Application

LRA Section 4.7.1 describes the applicant's TLAA for the reactor building crane load cycles. The LRA states that the reactor building crane serves both units at LSCS and was designed to meet the fatigue requirements of the ASME NOG-1-2004 and Crane Manufacturers Association of America (CMAA) Specification 70. The reactor building crane is a Class A crane that can be considered as experiencing "irregular occasional use followed by long idle periods." The LRA also states that the CMAA design allows for load cycles between 20,000 and 100,000 and has a design capacity of 125 tons. The LRA states that load cycles that are less than 50 percent of the design capacity of 125 tons (i.e., 62.5 tons) are considered to result in minimal fatigue of the crane; therefore, only lifts equal to or greater than 50 tons were evaluated. The LRA further states that the evaluation of the reactor building crane load cycles TLAA included (a) a review of the existing design basis to determine the number of load cycles considered in the 40-year design life of the crane, (b) the development of a 60-year projection for the crane load cycles, and (c) a comparison of the 60-year load cycle projection to the 40-year design load cycles of the crane. The LRA further states that the 60-year projected number of crane load cycles is 2,672 load cycles and this is less than 20 percent of the allowable design value of 20,000 load cycles.

The applicant dispositioned the TLAA for the reactor building crane in accordance with 10 CFR 54.21(c)(1)(i) to demonstrate that the analysis remains valid for the period of extended operation.

4.7.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor building crane and the corresponding disposition that the analysis remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i), consistent with the review procedures in SRP-LR Section 4.7.3.1.1, which state that existing analyses should be shown to be bounding for the period of extended operation. The SRP-LR also states that the applicant should show that conditions and assumptions used in the analysis already address the relevant aging effects for the period of extended operation and that acceptance criteria are maintained to provide reasonable assurance that the intended functions are maintained for renewal.

The staff reviewed LRA Section 4.7.1, ASME NOG-1-2004, UFSAR Section 9.1.4, UFSAR Appendix O, and CMAA Specification 70 and finds that the carbon steel reactor building crane is designed to meet the fatigue requirements for a Class A, "standby service" or "infrequent use," crane. The staff noted that, for the reactor building crane fatigue load cycle counting, the applicant only counted loads that lift greater than 50 tons (i.e., loads that are greater than 40 percent of the design capacity of 125 tons). The staff reviewed the applicant's UFSAR and noted that UFSAR Section 9.1.4 references a letter from Commonwealth Edison Company (CECo) to the NRC, dated October 19, 1982. The staff notes that CECo was the former licensee of LSCS and that Exelon is the current licensee and applicant of LSCS LRA. The letter provided information to the NRC on how the guidelines in Section 5.1.1 of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic Technical Activity A-36," dated July 1980, have been satisfied for LSCS. The letter stated, in part, that "fatigue failure was considered in the design. Assuming one refueling per year for a design plant life of 40 years gives an estimated number of lifts greater than 50 [percent] of crane capacity. 20 lifts/outage x 40 outages x 2 units = 1600 which is less than the 20,000 allowed in CMAA–70." UFSAR Section 9.1.4 states that the staff's evaluation provided in Supplement No. 5 to NUREG-0519, "Safety Evaluation Report Related to the Operation of LaSalle County Station, Units 1 and 2," dated August 1983, concludes that the guidelines in NUREG-0612, Section 5.1.1, have been satisfied for LSCS.

The staff noted that the letter dated October 19, 1982, is referenced in NUREG-0519, Supplement No 5; therefore, this information was considered by the staff in reaching its conclusion therein that LSCS meets the guidance in NUREG-0612, Section 5.1.1. During its review, the staff confirmed that (1) the staff previously found it acceptable to take into consideration, for fatigue cycle counting, only the crane lifts that are greater than 50 percent of crane capacity and (2) NUREG-0519 concludes that LSCS meets the guidance in NUREG-0612, Section 5.1.1. The staff also reviewed stress versus number of cycles (S-N) curves in the American Society for Metals *Atlas of Fatigue Curves*, dated 1986, and noted that, for ferrous metals, when the applied load/stress is below 50 percent of the fracture strength/stress, the fatigue life (i.e., number of cycles) of steel components increases significantly and an "infinite-life region" in the S-N curve is reached in which an infinite number of cycles can be applied without fatigue fracture. The staff finds the applicant's determination to not consider lifting loads less than 50 tons (i.e., loads that are less than 40 percent of the design capacity of 125 tons) for the reactor building crane fatigue cycle counting acceptable because this is consistent with LSCS CLB for the reactor building crane fatigue load cycle counting.

LRA Table 4.7.1-1 shows the 60-year projected total number of loading cycles based on the existing 40-year design basis. The 60-year total load cycles is projected to be 2,672 load cycles, which is less than 20 percent of the minimum design range of 20,000 to 100,000 load cycles.

Accordingly, the staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the reactor building crane remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.7.2.1 because the applicant's 60-year total load cycle projection demonstrated that the analysis remains valid for the period of extended operation.

4.7.1.3 UFSAR Supplement

LRA Section A.4.7.1 provides the UFSAR supplement summarizing the reactor building crane load cycles analysis. The staff reviewed LRA Section A.4.7.1, consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the applicant has to provide information to be included in the UFSAR supplement that includes a summary description of the evaluation of each TLAA. The SRP-LR also states that each summary description is reviewed to verify that it is appropriate such that later changes can be controlled by 10 CFR 50.59, "Changes, Tests and Experiments," and that the description should contain information that the TLAAs have been dispositioned for the period of extended operation.

Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the reactor building crane load cycles analysis, as required by 10 CFR 54.21(d).

4.7.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the reactor building crane load cycles remains valid for 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).

4.7.2 Main Steam Line Flow Restrictors Erosion Analysis

4.7.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2 describes the applicant's TLAA for the erosion of the main steam line flow restrictors. The LRA describes the restrictor assemblies as consisting of stainless steel verturi-type nozzles welded into the main steam line piping. The LRA refers to UFSAR Section 5.4.4, which indicates that very slow erosion of the venturi occurs with time and that the resulting slight enlargement has no safety significance. UFSAR Section 5.4.4 states that stainless steel was selected for the flow restrictor material because of its excellent resistance to erosion-corrosion in a high-velocity steam atmosphere. Flow velocities in the venturi range from 150 ft/sec at the inlet to 600 ft/sec in the throat. UFSAR Section 5.4.4 also states that the material's resistance to corrosion has been substantiated by turbine inspections at Dresden Nuclear Power Station, Unit 1, where no noticeable effects from erosion were found on the stainless steel nozzle partitions with inlet velocities of 300 ft/sec and exit velocities from 600 to 900 ft/sec. The UFSAR Section 5.4.4 states that even if erosion rates are as high as 0.004-inch per year, after 40 years of operation, the increase in restrictor choked flow rate would be no more than 5 percent, and a 5 percent increase in the radiological dose calculated for the main steam line break accident is not significant.

The LRA evaluated the TLAA by stating that, as discussed in UFSAR Section 15.6.4 and UFSAR Table 15.6-8, the radiological consequences of a main steam line break would result in a whole body dose at the exclusion area boundary of 0.0354 rem, which is well below the limit of 25 rem in 10 CFR Part 100, "Reactor Site Criteria." The LRA stated that, even if the choked flow rate is increased an additional 5 percent (for a total increase of 10 percent) to account for the additional 20 years of service, the increase in dose consequences is negligible relative to the 10 CFR Part 100 limits.

The applicant dispositioned the TLAA for the erosion of the main steam line flow restrictors in accordance with 10 CFR 54.21(c)(1)(ii), that the analysis has been projected through the period of extended operation with acceptable results.

4.7.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the erosion of the main steam line flow restrictors and the corresponding disposition in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the review procedures in SRP-LR Section 4.7.3.1.2. These procedures state that the staff is to review the results of the applicant's revised analysis to verify that the evaluation period has been extended such that the analysis is valid for the period of extended operation. SRP-LR Section 4.7.3.1.2 also states that the applicant may recalculate the analysis using a 60-year period to show that the acceptance criteria continue to be satisfied for the period of extended operation.

The staff reviewed the UFSAR and confirmed that Section 5.4.4 states that calculations have shown that an erosion rate of 0.004 inch per year would result in a maximum increase in restrictor choked flow rate of 5 percent after 40 years of operation. The staff also reviewed UFSAR Section 15.6.4 and UFSAR Table 15.6-8 and confirmed that the original design basis analysis performed for 40 years of operation determined that a main steam line break would result in a whole body dose at the exclusion area boundary of 0.0354 rem. The staff reviewed the methodology used by the applicant to project the analysis to the end of the period of extended operation and finds it to be acceptable because doubling the effects of the current operating period bounds the effects for the period of extended operation and because the resulting increase in calculated exposures continue to be a small fraction of 10 CFR Part 100 guidelines.

Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for the erosion of the main steam line flow restrictors has been projected to the end of the period of extended operation. Additionally, this meets the acceptance criteria in SRP-LR Section 4.7.2.1.

4.7.2.3 UFSAR Supplement

LRA Section A.4.7.2 provides the UFSAR supplement summarizing the erosion of the main steam line flow restrictors. The staff reviewed the LRA Section A.4.7.2, consistent with the review procedures in SRP-LR Section 4.7.3.2, which state that the information to be included in the UFSAR supplement includes a summary description of the evaluation of each TLAA. Based on its review of the UFSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.3.2 and, therefore, is acceptable. Additionally, the staff determines that the applicant provided an adequate summary description of its actions to address the main steam line flow restrictor erosion analysis, as required by 10 CFR 54.21(d).

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the analysis for erosion of the main steam line flow restrictors 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 TLAAs

The staff reviewed the information in LRA Section 4, “Time-Limited Aging Analyses.” On the basis of its review, the staff concludes 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 for 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) the effects of aging on intended functions will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient 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 to comply with 10 CFR 54.29(a) are in accordance with the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10 of the *Code of Federal Regulations* Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” the Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for LaSalle County Station, Units 1 and 2 (LSCS). The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) presented its safety evaluation report (SER) with open items to the ACRS Subcommittee on Plant License Renewal in a public meeting on April 19, 2016. The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report is issued. Exelon Generation Company, LLC (Exelon or the applicant), and the staff will meet with the full committee to discuss the closure of the open items and other issues associated with the review of the LRA.

After the staff issues its final SER and 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 the SER will include the ACRS report and the staff’s response to any issues and concerns reported.

SECTION 6

CONCLUSION

The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) reviewed the license renewal application (LRA) for LaSalle County Station, Units 1 and 2 (LSCS), in accordance with NRC regulations and NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated December 2010. Title 10 of the *Code of Federal Regulations* (10 CFR) 54.29, "Standards for Issuance of a Renewed License," sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff determines that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," Subpart A, "National Environmental Policy Act – Regulations Implementing Section 102(2)," will be documented in a plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 57, Regarding LaSalle County Station, Units 1 and 2."

APPENDIX A

LICENSE RENEWAL COMMITMENTS

A. License Renewal Commitments

During the review of the LaSalle County Station, Units 1 and 2 (LSCS), license renewal application (LRA) by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff), Exelon Generation Company, LLC (Exelon or the applicant), made commitments related to aging management programs (AMPs) and time limited aging analyses (TLAAs) to manage aging effects for structures and components. The following table lists these commitments, as of April 30, 2016, along with the implementation schedules and sources for each commitment. The period of extended operation starts on April 17, 2022, for LSCS, Unit 1, and on December 16, 2023, for LSCS, Unit 2.

Table A.1-1 LaSalle County Station, Units 1 and 2, License Renewal Commitments

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Existing program is credited.	Ongoing	Section A.2.1.1
2	Water Chemistry	Existing program is credited.	Ongoing	Section A.2.1.2
3	Reactor Head Closure Stud Bolting	Existing program is credited.	Ongoing	Section A.2.1.3
4	BWR Vessel ID Attachment Welds	Existing program is credited.	Ongoing	Section A.2.1.4
5	BWR Feedwater Nozzle	Existing program is credited.	Ongoing	Section A.2.1.5
6	BWR Control Rod Drive Return Line Nozzle	Existing program is credited.	Ongoing	Section A.2.1.6
7	BWR Stress Corrosion Cracking	Existing program is credited.	Ongoing	Section A.2.1.7
8	BWR Penetrations	Existing program is credited.	Ongoing	Section A.2.1.8

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
9	BWR Vessel Internals	BWR Vessel Internals is an existing program that will be enhanced to: 1. Perform an assessment of the susceptibility of reactor vessel internal components fabricated from CASS to loss of fracture toughness due to thermal aging embrittlement. If material properties cannot be determined to perform the screening, they will be assumed susceptible to thermal aging for the purposes of determining program examination requirements. 2. Perform an assessment of the susceptibility of reactor vessel internal components fabricated from CASS to loss of fracture toughness due to neutron irradiation embrittlement. 3. Specify the required periodic inspection of CASS components determined to be susceptible to loss of fracture toughness due to thermal aging and neutron irradiation embrittlement. The initial inspections will be performed either prior to or within five years after entering the period of extended operation. 4. Install core plate wedges no later than six months prior to the period of extended operation, or before the end of the last refueling outage prior to the period of extended operation, whichever occurs later; or, submit an inspection plan for the core plate rim hold-down bolts with a supporting analysis for NRC approval at least 2 years prior to entering the period of extended operation.	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.9 Exelon Letter RS-16-003 01/07/2016 Exelon Letter RS-16-007 01/14/2016
10	Flow-Accelerated Corrosion	Existing program is credited.	Ongoing	Section A.2.1.10
11	Bolting Integrity	Bolting Integrity is an existing program that will be enhanced to: 1. Provide guidance to ensure proper specification of bolting material, lubricant and sealants, storage, and installation torque or tension to prevent or mitigate degradation and failure of closure bolting for pressure-retaining bolted joints. 2. Prohibit the use of lubricants containing molybdenum disulfide on pressure-retaining bolted joints. 3. Minimize the use of high strength bolting (actual measured yield strength equal to or greater than 150 ksi) for pressure-retaining bolted joints in portions of systems within the scope of the Bolting Integrity program. High strength bolting (regardless of code classification) will be monitored for	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.11 Exelon Letter RS-15-194 08/06/2015 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		cracking in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1. 4. Perform inspection of submerged bolting for the emergency core cooling systems (ECCS) and reactor core isolation cooling (RCIC) system suction strainers in the suppression pool for loss of material and loss of preload during each ISI inspection interval. 5. Perform inspection of submerged bolting for the service water diver safety barriers and diesel fire pump suction screens for loss of material and loss of preload each refuel interval. 6. Perform inspection of submerged bolting for the Lake Screen House travelling screens framework for loss of material and loss of preload each refueling interval.		

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
12	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System is an existing program that will be enhanced to: 1. Perform a minimum of 10 microbiologically influenced corrosion (MIC) degradation inspections for aboveground piping in the Essential Cooling Water System every 24 months until the rate of MIC occurrences no longer meets the criteria for recurring internal corrosion. The selected inspection locations will be periodically reviewed to validate their relevance and usefulness and adjusted as appropriate. Evaluation of the inspection results will include; (1) a comparison to the nominal wall thickness or previous wall thickness measurements to determine rate of corrosion degradation; (2) a comparison to the design minimum allowable wall thickness to determine the acceptability of the component for continued use; and (3) a determination of re-inspection interval. A portion of these inspection locations will be selected with process conditions similar (e. g. flow, temperature) to those in buried portions of the piping to provide sufficient understanding of the condition of the buried piping. 2. Perform a minimum of 10 MIC degradation inspections for in scope aboveground piping in the Nonessential Cooling Water System every 24 months until the rate of MIC occurrences no longer meets the criteria for recurring internal corrosion. The selected inspection locations will be periodically reviewed to validate their relevance and usefulness and adjusted as appropriate. Evaluation of the inspection results will include (1) a comparison to the nominal wall thickness or previous wall thickness measurements to determine rate of corrosion degradation; (2) a comparison to the design minimum allowable wall thickness to determine the acceptability of the component for continued use; and (3) a determination of re-inspection interval. A portion of these inspection locations will be selected with process conditions similar (e. g. flow, temperature) to those in buried portions of the piping to provide sufficient understanding of the condition of the buried piping.	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.12 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		3. Select an inspection method that will provide indication of suitable wall thickness to perform inspections on a representative sample of buried piping to supplement the aboveground piping inspection locations. 4. Perform visual inspections of the interior surface of buried portions of the Essential Cooling Water System and Nonessential Cooling Water System whenever the piping internal surface is made accessible due to maintenance and repair activities.		
13	Closed Treated Water Systems	Closed Treated Water Systems is an existing program that will be enhanced to: 1. Perform condition monitoring, including periodic visual inspections and non-destructive examinations, to verify the effectiveness of water chemistry control to mitigate aging effects. A representative sample of piping and components will be selected based on likelihood of corrosion, stress corrosion cracking, or fouling, and inspected at an interval not to exceed once in 10 years during the period of extended operation. The selection of components to be inspected will focus on locations which are most susceptible to age-related degradation, where practical. 2. Monitor and trend drywell penetration cooling coil outlet temperatures monthly to ensure that adequate cooling is being provided to the concrete adjacent to the drywell penetrations.	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.13 Exelon Letter RS-15-193 08/06/2015 Exelon Letter RS-16-003 01/07/2016
14	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems is an existing program that will be enhanced to: 1. Provide additional guidance to include inspection of structural components, rails, and bolting for loss of material due to corrosion; rails for loss of material due to wear; and bolted connections for loss of preload.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.14 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
15	Compressed Air Monitoring	Compressed Air Monitoring is an existing program that will be enhanced to: 1. Inspect the internal surfaces of system filters, compressors, and after-coolers for signs of corrosion and corrosion products. 2. Perform analysis and trending of air quality monitoring results and visual inspection results. 3. Document deficiencies which are identified during visual inspections of the internal surfaces of system components in the corrective action program.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.15 Exelon Letter RS-16-003 01/07/2016
16	Fire Protection	Fire Protection is an existing program that will be enhanced to: 1. Perform periodic visual inspection of combustible liquid spill retaining curbs. 2. Perform periodic visual inspection for identification of corrosion that may lead to loss of material on the external surfaces of the low pressure carbon dioxide fire suppression systems. 3. Provide additional inspection guidance to identify aging effects as follows: a. Fire barrier walls, ceilings, and floors degradation such as spalling, cracking, and loss of material for concrete. b. Elastomeric fire barrier material degradation such as loss of material, shrinkage, separation from walls and components, increased hardness and loss of strength. 4. Provide additional inspection guidance to identify degradation of fire barrier penetration seals for aging effects such as loss of material, cracking, increased hardness, shrinkage, and loss of strength.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.16 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
17	Fire Water System	Fire Water System is an existing program that will be enhanced to: 1. Perform volumetric examinations at five locations on the carbon steel aboveground fire water piping susceptible to microbiologically induced corrosion (MIC) every year to identify loss of material. Additional locations will be examined if these volumetric examinations or plant operating experience identify significant degradation. For through-wall leaks and material loss greater than 50 percent of nominal wall, four additional locations will be examined. Where the identified material loss is 30 percent to 50 percent of nominal wall thickness and the calculated remaining life is less than two years, two additional locations will be examined. 2. Perform visual inspections, for loss of material and flow obstructions, of the accessible header piping and sparger external surfaces for the deluge systems located within filter plenums on a once per refueling cycle frequency. The visual inspection will include verification that the piping and spargers are in their proper position and that there are no obstructions to the desired spray patterns. 3. Perform internal visual inspections of sprinkler and deluge system piping to identify internal corrosion and obstructions to flow. If the presence of sufficient foreign organic or inorganic material to obstruct pipe or sprinklers is detected during pipe inspections, the material is removed and its source is determined and corrected where possible. Followup volumetric examinations will be performed if internal visual inspections detect age-related degradation in excess of what would be expected accounting for design, previous inspection experience, and inspection interval. The internal visual inspections will consist of the following: a. Wet pipe sprinkler systems – 50 percent of the wet pipe sprinkler systems in scope for license renewal will have visual internal inspections of piping performed every five years consistent with NFPA 25, 2011 Edition, Section 14.2.	Program to be enhanced no later than six months prior to the period of extended operation. Inspections described in Enhancement 3.d.i and 3.d.ii, if required, will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.17 Exelon Letter RS-15-171 07/01/2015 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		b. Dry pipe sprinkler systems - Dry pipe sprinkler systems in scope for license renewal will have visual internal inspections of piping performed every five years consistent with NFPA 25, 2011 Edition, Section 14.2. c. Deluge systems - Deluge systems in scope for license renewal, except for the charcoal filter deluge systems, will have visual internal inspections of piping performed every five years consistent with NFPA 25, 2011 Edition, Section 14.2. i. The in scope charcoal filter deluge systems will have visual internal inspections performed on one of the 11 systems every five years. If degraded conditions are identified, the inspections will be expanded to include all 11 charcoal filter systems every five years. d. Sprinkler and deluge systems that are normally dry but may be wetted as the result of testing or actuations will have additional tests and inspections on piping segments that cannot be drained or piping segments that allow water to collect. i. These additional inspections, if required, will be performed in each five-year interval beginning five years prior to the period of extended operation. ii. This additional inspection consists of either a flow test or flush sufficient to detect potential flow blockage or a visual inspection of 100 percent of the internal surface of piping segments that cannot be drained or piping segments that allow water to collect. iii. In addition, in each five-year interval of the period of extended operation, 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect is subject to volumetric wall thickness inspections.		

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		4. Perform obstruction evaluations when degraded conditions are identified by visual inspections, flow testing, or volumetric examinations. The obstruction evaluations will include an extent of condition determination, need for increased inspections, and followup examinations if internal visual inspections detect age-related degradation in excess of what would be expected accounting for design, previous inspection experience, and inspection interval. 5. Perform flow tests for hose stations at the hydraulically most limiting locations for each zone of the system on a five-year frequency to demonstrate the capability to provide the design pressure at required flow. 6. Perform annual air tests on deluge systems supporting charcoal filter units excluding the “A” and “B” Auxiliary Electric Equipment Room Supply Air Filter units and the High Radiation Sampling System Filter unit. Perform visual internal inspections of the excluded filter units deluge systems in the event blockage was found on any deluge system that could be generic in nature. 7. Perform visual inspections of all charcoal filter unit deluge nozzles for proper orientation and verification that the nozzles are not obstructed on a 24 month frequency. 8. Include inspection for water leakage and loss of fluid in the glass bulbs of sprinkler heads, when performing visual inspections of sprinkler systems. 9. Include in main drain test acceptance criteria, the monitoring of flowing pressures from test to test. If there is a ten percent reduction in full flow pressure when compared to previously performed tests, an issue report shall be generated in the corrective action program to determine the cause and correct if necessary. 10. Maintain yard loop flow testing at a two year frequency until such time that the restricted section of piping from the pump house to Node 515 is restored to normal flow conditions.		

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
18	Aboveground Metallic Tanks	Aboveground Metallic Tanks is an existing program that will be enhanced to: 1. Perform a visual inspection of the tank shell, roof, and bottom interior surfaces for signs of loss of material on one of the cycled condensate storage tanks within five years prior to the period of extended operation. This inspection shall include both wetted and non-wetted surfaces and may be either direct visual inspection from inside the tanks or volumetric examination from outside the tank. A volumetric examination from outside the tank will include 25 percent of the tank surface area. Should the one-time inspection identify degradation, periodic inspections with an inspection frequency based on the rate of degradation will be established for both tanks. 2. Perform a visual inspection of the exterior surfaces of both cycled condensate storage tanks for loss of material each refueling interval. 3. Perform a volumetric examination of the tank bottom for both cycled condensate storage tanks for signs of loss of material whenever the tanks are drained. At a minimum, an inspection shall be performed within 10 years prior to the period of extended operation and subsequent inspections shall be performed in each 10-year period during the period of extended operation. The next inspection scope will include 100% of the accessible areas of each of the tank bottoms that are within 30 inches of the shell. Included in this scope are the patch plates that are directly exposed to the sand bed below. Additionally, 10 random locations of approximately one square foot each, outside of the 30 inch band, will be inspected. This inspection program will encompass approximately 20% of the tank bottom and will inspect all the susceptible areas which were found during the baseline inspections. Based on the results of this inspection, the scope will be reassessed for future tank bottom inspections, per the Corrective Action Program. 4. Perform an inspection of the caulking at the perimeter of the cycled condensate storage tank bases for signs of degradation each refueling interval (caulking inspections are supplemented with physical manipulation).	Program to be enhanced no later than six months prior to the period of extended operation. Inspections described in Enhancements 1 and 3 will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.18 Exelon Letter RS-15-193 08/06/2015 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
19	Fuel Oil Chemistry	Fuel Oil Chemistry is an existing program that will be enhanced to: 1. Perform periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and the levels of microbiological organisms for diesel fuel storage tanks 0DO01T, 1DO01T, and 2DO01T. 2. Perform periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and the levels of microbiological organisms for HPCS diesel fuel storage tanks 1DO02T and 2DO02T. 3. Perform periodic (quarterly) sampling and analysis for water and sediment content and the levels of microbiological organisms for diesel generator day tanks 0DO02T, 1DO05T, and 2DO05T. 4. Perform periodic (quarterly) sampling and analysis for water and sediment content and the levels of microbiological organisms for HPCS diesel day tanks 1DO04T and 2DO04T. 5. Perform periodic (quarterly) sampling and analysis for water and sediment content, particulate concentration, and the levels of microbiological organisms for diesel fire pump day tanks 0FP01TA and 0FP01TB. 6. Perform periodic internal inspections of diesel fire pump day tanks 0FP01TA and 0FP01TB at least once during the 10-year period prior to the period of extended operation, and at least once every 10 years during the period of extended operation. Each diesel fuel tank will be drained and cleaned, the internal surfaces visually inspected (if physically possible), and, if evidence of degradation is observed during inspections, or if visual inspection is not possible, these diesel fuel tanks will be volumetrically inspected. 7. Perform volumetric inspection of diesel fuel storage tanks 0DO01T, 1DO01T, and 2DO01T; HPCS diesel fuel storage tanks 1DO02T and 2DO02T; diesel generator day tanks 0DO02T, 1DO05T, and 2DO05T; and HPCS diesel day tanks 1DO04T and 2DO04T if evidence of degradation is observed during visual inspection, or if visual inspection is not possible.	Program to be enhanced no later than six months prior to the period of extended operation. Inspections described in Enhancements 6 and 7 will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.19 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		8. Perform periodic (quarterly) trending of water and sediment content, particulate concentration, and the levels of microbiological organisms for all fuel oil tanks within the scope of the program.		
20	Reactor Vessel Surveillance	Reactor Vessel Surveillance is an existing program that will be enhanced to: 1. Establish a maximum fluence limit of 6.25E+17 n/cm^2 (39.15 EFPY) for monitoring the limiting Unit 1 axial welds to ensure that the axial weld failure probability does not exceed 5.02E-06 per reactor year. 2. Complete a probabilistic axial weld failure analysis for Unit 1 that demonstrates the 60-year axial weld failure probability is no greater than 5.02E-06 per reactor year. Submit the analysis to the NRC for review and approval.	Enhancement 1 to be implemented no later than six months prior to the period of extended operation. Enhancement 2 to be completed at least three years prior to the limiting Unit 1 axial welds reaching the fluence limit of 6.25E+17 n/cm^2 (39.15 EFPY).	Section A.2.1.20 Section A.4.2.5 Exelon Letter RS-15-223 08/26/2015 Exelon Letter RS-15-281 10/29/2015 Exelon Letter RS-16-003 01/07/2016
21	One-Time Inspection	One-Time Inspection is a new condition monitoring program that will be used to verify the system-wide effectiveness of the Water Chemistry (A.2.1.2) program, Fuel Oil Chemistry (A.2.1.19) program, and Lubricating Oil Analysis (A.2.1.26) program which are designed to prevent or minimize aging to the extent that it will not cause a loss of intended function during the period of extended operation.	Program to be implemented no later than six months prior to the period of extended operation. One-time inspections will be performed within the 10 years prior to the period of extended operation, and will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.1.21 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
22	Selective Leaching	Selective Leaching is a new condition monitoring program that will include one-time inspections of a representative sample of susceptible components to determine if loss of material due to selective leaching is occurring.	Program to be implemented no later than six months prior to the period of extended operation. One-time inspections will be performed within the five years prior to the period of extended operation, and will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.1.22 Exelon Letter RS-16-003 01/07/2016
23	Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping	Unit 1 One-time Inspection of ASME Code Class 1 Small-Bore Piping is a new condition monitoring program that will manage the aging effect of cracking in ASME Code Class 1 small-bore piping that is less than nominal pipe size (NPS) 4-inches, and greater than or equal to NPS 1-inch.	Program to be implemented no later than six months prior to the period of extended operation. One-time Inspections will be performed within the six years prior to the period of extended operation, and will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.1.23 Exelon Letter RS-15-193 08/06/2015 Exelon Letter RS-16-003 01/07/2016
24	External Surfaces Monitoring of Mechanical Components	External Surfaces Monitoring of Mechanical Components is a new condition monitoring program that directs visual inspections of external surfaces of components be performed during system inspections and walkdowns.	Program to be implemented no later than six months prior to the period of extended operation.	Section A.2.1.24 Exelon Letter RS-16-003 01/07/2016
25	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Internal Surfaces in Miscellaneous Piping and Ducting Components is new condition monitoring program that will consist of inspections of the internal surfaces of metallic and elastomeric components such as piping, piping components and piping elements, ducting components, tanks, heat exchanger components, elastomers, and other components that are exposed to environments of condensation, diesel exhaust, and waste water.	Program to be implemented no later than six months prior to the period of extended operation.	Section A.2.1.25 Exelon Letter RS-16-003 01/07/2016
26	Lubricating Oil Analysis	Existing program is credited.	Ongoing	Section A.2.1.26

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
27	Monitoring of Neutron-Absorbing Materials Other than Boraflex	Monitoring of Neutron-Absorbing Materials Other than Boraflex is an existing program that will be enhanced to: 1. Maintain the test coupon exposure such that it is bounding for the neutron-absorbing material in all spent fuel racks, by relocating the coupon tree to a different spent fuel rack cell location each cycle and by surrounding the coupons with a greater number of freshly discharged fuel assemblies than that of any other cell location.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.27 Exelon Letter RS-16-003 01/07/2016
28	Buried and Underground Piping	Buried and Underground Piping is an existing program that will be enhanced to: 1. Manage cracking for stainless steel piping, utilizing a method that has been demonstrated to be capable of detecting cracking, whenever coatings are removed and expose the base material. 2. Ensure all underground carbon steel Essential Cooling Water System and Nonessential Cooling Water System piping and components within the scope of license renewal are coated in accordance with Table 1 of NACE SP0169-2007. 3. Define acceptable coating conditions as coating exhibiting either no evidence of degradation, or, the type and extent of coating damage evaluated as insignificant by: (a) an individual possessing a NACE Coating Inspector Program Level 2 or 3 operator qualification, (b) an individual who has attended the Electric Power Research Institute (EPRI) Comprehensive Coatings Course and completed the EPRI Buried Pipe Condition Assessment and Repair Training Computer Based Training Course, or (c) a coatings specialist qualified in accordance with an ASTM standard endorsed in Regulatory Guide 1.54, Rev. 2, “Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants.” 4. Perform inspection quantities of buried piping within the scope of license renewal in accordance with LR-ISG-2015-01 Table XI.M41-2 and LR-ISG-2015-01, Appendix B, “Evaluation and Technical Basis” section, items 4.a and 4.b, during each 10-year period, beginning 10 years prior to the period of extended operation. The number of inspections of buried piping will be based upon the as-found results of cathodic	Program to be enhanced no later than six months prior to the period of extended operation. Enhancement 2 and inspections described in Enhancements 4 and 5 will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later Additional schedule information identified in commitment.	Section A.2.1.28 Exelon Letter RS-16-003 01/07/2016 Exelon Letter RS-16-070 04/13/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		protection system availability and effectiveness. The length of piping for each inspection will be based on the recommendations in LR-ISG-2015-01, Appendix B, "Evaluation and Technical Basis" section, item 4.c. 5. Perform direct visual inspections of underground Essential Cooling Water System and Nonessential Cooling Water System piping within the scope of license renewal during each 10-year period, beginning 10 years prior to the period of extended operation. 6. When measured pipe wall thickness, projected to the end of the period of extended operation, does not meet the minimum pipe wall thickness requirements, the number of inspections within the affected piping categories will be doubled or increased by five (5), whichever is smaller. If adverse indications are found in the expanded sample, an analysis will be conducted to determine the extent of condition and extent of cause. The size of the followup inspections will be determined based on the analysis. Timing of the additional inspections will be based on the severity of the identified degradation and the consequences of leakage. The additional inspections will be performed within the same 10-year inspection interval in which the original degradation was identified, or within 4-years after the end of the 10-year interval if the degradation was identified in the latter half of the 10-year interval. Expansion of sample size may be limited by the extent of piping subject to the observed degradation mechanism or if the piping system or portion of the system is replaced. 7. Use only the -850mV relative to a CSE (copper/copper sulfate reference electrode), instant off criterion specified in NACE SP0169-2007 for acceptance criteria for steel piping and determination of cathodic protection system effectiveness in performing cathodic protection surveys. Alternatively, soil corrosion probes may also be used to demonstrate cathodic protection effectiveness during the annual surveys. An upper limit of -1200mV for pipe-to-soil potential measurements of coated pipes will also be established, so as to preclude potential damage to coatings.		

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		8. Conduct an extent of condition evaluation if observed coating damage caused by non-conforming backfill has been evaluated as significant. The extent of condition evaluation will be conducted to ensure that the as-left condition of backfill in the vicinity of the observed damage will not lead to further degradation.		
29	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE is an existing program that will be enhanced to: 1. Provide guidance for proper specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting. 2. If leakage from the reactor cavity pool drain line welds exists, then perform ultrasonic thickness measurements on the Unit 2 drywell liner at 0 and 180 degrees for several feet below elevation 813. The inspections will begin in 2015 and a periodic inspection frequency will be established based on the inspection results.	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.29 Exelon Letter RS-16-003 01/07/2016
30	ASME Section XI, Subsection IWL	ASME Section XI, Subsection IWL is an existing program that will be enhanced to: 1. Explicitly require that areas of concrete deterioration and distress be recorded in accordance with the guidance provided in ACI 349.3R. 2. Include quantitative acceptance criteria, based on the "Evaluation Criteria" provided in Chapter 5 of ACI 349.3R, that will be used to augment the qualitative assessment of the Responsible Engineer.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.30 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
31	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF is an existing program that will be enhanced to: 1. Provide guidance for proper specification of bolting material, storage, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting. Requirements for high strength bolts shall include the preventive actions for storage, lubricants, and stress corrosion cracking potential discussed in Section 2 of RCSC (Research Council on Structural Connections) publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts." Lubricants that contain molybdenum disulfide (MoS_2) shall not be applied to high strength bolts within the scope of license renewal. Bolting material with actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa, in sizes greater than 1 inch nominal diameter shall not be used in supports for ASME Class 1, 2, and 3 piping and components or supports for MC components. 2. Provide guidance, regarding the selection of supports to be inspected on subsequent inspections, when a support is repaired in accordance with the corrective action program. The enhanced guidance will ensure that the supports inspected on subsequent inspections are representative of the general population.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.31 Exelon Letter RS-15-180 7/15/2015 Exelon Letter RS-16-003 01/07/2016
32	10 CFR Part 50, Appendix J	Existing program is credited.	Ongoing	Section A.2.1.32
33	Masonry Walls	Masonry Walls is an existing program that will be enhanced to: 1. Provide guidance for inspection of masonry walls for separation and gaps between the supports and masonry walls. 2. Require that personnel performing inspections and evaluations meet the qualifications described in ACI 349.3R.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.33 Exelon Letter RS-15-180 07/15/2015 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
34	Structures Monitoring	Structures Monitoring is an existing program that will be enhanced to: 1. Add the following components and commodities: a. Pipe, electrical, and equipment component support members b. Pipe whip restraints and jet impingement shields c. Panels, racks, cabinets, and other enclosures d. Sliding surfaces e. Sumps f. Electrical cable trays and conduits g. Electrical duct banks h. Tube tracks i. Transmission tower (including takeoff towers) and foundation (including cycled condensate storage tank foundations) j. Penetration seals and sleeves k. Blowout panels l. Permanent drywell shielding m. Transformer foundation n. Bearing pads o. Compressible joints p. Hatches, plugs, handholes, and manholes q. Metal components (decking, vent stack, and miscellaneous steel) r. Building features – doors and seals, bird screens, louvers, windows, and siding s. Concrete curbs, and anchors t. Turbine Building smoke and heat vent housings	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.34 Exelon Letter RS-15-180 07/15/2015 Exelon Letter RS-15-238 09/17/2015 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
		2. Provide guidance for proper specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting. 3. Revise storage requirements for high strength bolts to include recommendations of Research Council on Structural Connections (RCSC) Specification for Structural Joints Using High Strength Bolts, Section 2.0. 4. Require acceptance and evaluation of structural concrete using quantitative criteria based on Chapter 5 of ACI 349.3R. 5. Monitor raw water and ground water chemistry on a frequency not to exceed five years for pH, chlorides, and sulfates and verify that it remains non-aggressive, or evaluate results exceeding criteria to assess impact, if any, on below-grade concrete. 6. Monitor concrete for increase in porosity and permeability, inspection of accessible sliding surfaces for indication of significant loss of material due to wear or corrosion, debris, or dirt. 7. Evaluate 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, and examine representative samples of the exposed portions of the below grade concrete when excavated for any reason. 8. Require that personnel performing inspections and evaluations meet the qualifications specified within ACI 349.3R with respect to knowledge of inservice inspection of concrete and visual acuity requirements. 9. Clarify that loose bolts and nuts and cracked high strength bolts are not acceptable unless accepted by engineering evaluations. 10. Inspect the fiberglass outer covering for the permanent drywell shielding for signs of rips and tears. If a rip or tear is found, repair or replace the permanent drywell shielding.		

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
35	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants is an existing program that will be enhanced to: 1. Include monitoring of the following: a. Submerged Core Standby Cooling System Pond and Intake Flume (includes earthen walls, south flume concrete retaining wall, and north flume sheet piling retaining wall) b. Core Standby Cooling System outfall structure c. Bar racks and miscellaneous steel d. Shad net anchors e. Lake Screen House (includes service water tunnel) 2. Monitor raw water and ground water chemistry at least once every five years for pH, chlorides, and sulfates and verify that it remains non-aggressive, or evaluate results exceeding criteria to assess impact, if any, on buried or submerged concrete. 3. Provide guidance for proper specification of bolting material, lubricant and sealants, and installation torque or tension to prevent or mitigate degradation and failure of structural bolting, and preventative actions for storage of materials to prevent stress corrosion cracking. 4. Require acceptance and evaluation of structural concrete using quantitative criteria based on Chapter 5 of ACI 349.3R. 5. Require inspection of accessible in scope portions of the Cooling Lake and Lake Screen House immediately following the occurrence of significant natural phenomena, which includes intense local rainfalls and large floods. 6. Require: a. The evaluation of the acceptability of inaccessible areas when conditions exist in the accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas. b. Examination of the exposed portions of the below grade concrete when excavated for any reason.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.2.1.35 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
36	Protective Coating Monitoring and Maintenance Program	Existing program is credited.	Ongoing.	Section A.2.1.36
37	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is a new program that will be used to manage reduced insulation resistance of the insulation material for non-EQ cables and connections. Accessible cables and connections located in adverse localized environments will be visually inspected at least once every 10 years for indications of reduced insulation resistance, such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination.	Program to be implemented no later than six months prior to the period of extended operation. Initial inspections will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.37 Exelon Letter RS-16-003 01/07/2016
38	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits is a new program that will be used to manage the effects of reduced insulation resistance of non-EQ cable and connection insulation of the in scope portions of Neutron Monitoring, Process Radiation Monitoring and Area Radiation Monitoring Systems. Calibration and cable tests will be performed and results will be assessed for reduced insulation resistance prior to the period of extended operation. Cable test frequency is based on engineering evaluation and is performed at least once every 10 years. Calibration and assessment of results is performed at least once every 10 years during the period of extended operation.	Program to be implemented no later than six months prior to the period of extended operation. Initial testing and assessment of results will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.38 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
39	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is a new program that will be used to manage the effects of reduced insulation resistance of non-EQ, in scope, inaccessible power cables. Cables will be tested using one or more proven tests for detecting deterioration of the insulation system. The cables will be tested at least once every six years. More frequent testing may occur based on test results and operating experience. Manholes associated with the cables included in this aging management program will be inspected for water collection with subsequent corrective actions (e.g., water removal), as necessary. Prior to the period of extended operation, the frequency of inspections for accumulated water will be established and adjusted based on plant specific operating experience with cable wetting or submergence, including water accumulation over time and event driven occurrences such as heavy rain or flooding. Operation of dewatering devices will be verified prior to any known or predicted heavy rain or flooding event. During the period of extended operation, the inspections will occur at least annually.	Program to be implemented no later than six months prior to the period of extended operation. Initial tests and inspections will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later. Additional schedule information identified in commitment.	Section A.2.1.39 Exelon Letter RS-16-003 01/07/2016
40	Metal Enclosed Bus	Metal Enclosed Bus is an existing program that will be enhanced to: 1. Specify internal inspections will be performed for accessible non-segregated bus duct sections that are in scope for license renewal. 2. Clarify requirements for visual inspections of internal portions (bus enclosure assemblies); bus insulation; internal bus insulating supports; accessible gaskets, boots and sealants; and bus duct external surfaces. 3. Specify a sample size of 20 percent of the accessible bolted connection population, with a maximum sample size of 25, will be inspected for increased resistance of connection by either thermography or measuring the connection resistance using a micro ohmmeter. 4. Specify an inspection frequency of at least every 10 years.	Program to be enhanced no later than six months prior to the period of extended operation. Additional schedule information identified in commitment.	Section A.2.1.40 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
41	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will implement one-time testing of a representative sample (20 percent with a maximum sample size of 25) of non-EQ electrical cable connections to ensure that either increased resistance of connection is not occurring or that the existing preventive maintenance program is effective such that a periodic inspection program is not required.	Program to be implemented no later than six months prior to the period of extended operation. One-time tests will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.1.41 Exelon Letter RS-16-003 01/07/2016
42	Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program	Service Level III and Service Level III Augmented Coatings Monitoring and Maintenance Program is a new condition monitoring program that performs periodic visual inspections to verify the integrity of internal coatings designed to adhere to and protect the base metal.	Program to be implemented no later than six months prior to the period of extended operation. Baseline inspections will occur in the 10-year period prior to the period of extended operation, and will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.2.1 Exelon Letter RS-16-003 01/07/2016
43	Fatigue Monitoring	Fatigue Monitoring is an existing program that will be enhanced to: 1. Impose administrative transient cycle limits corresponding to the limiting numbers of cycles used in the environmental fatigue calculations. 2. Evaluate the impact of the reactor coolant environment on Class 1 components including valves and pumps if they are more limiting than those considered in NUREG/CR-6260.	Program to be enhanced no later than six months prior to the period of extended operation. Any additional environmental fatigue evaluations will be completed no later than six months prior to the period of extended operation.	Section A.3.1.1 Exelon Letter RS-16-003 01/07/2016
44	Concrete Containment Tendon Prestress	Concrete Containment Tendon Prestress is an existing condition monitoring program that will be enhanced to: 1. For each surveillance interval, trending lines will be updated through the period of extended operation as part of the regression analysis and compared to the predicted lower limit and minimum required values for each tendon group.	Program to be enhanced no later than six months prior to the period of extended operation.	Section A.3.1.2 Exelon Letter RS-16-003 01/07/2016

Item Number	Program or Topic	Commitment	Enhancement or Implementation Schedule	Source
45	Environmental Qualification (EQ) of Electric Components	Existing program is credited.	Ongoing	Section A.3.1.3
46	Operating Experience	Existing program is credited.	Ongoing	Section A.1.6
47	TLAA - Slip Joint Clamp	Prior to exceeding the limiting fluence value of 1.17E+20 n/cm^2 at the Unit 1 jet pump slip joint clamp location, estimated to be at 50.7 EFPY, revise the analysis for the slip joint clamps for a higher acceptable fluence value or take other corrective action such as repair or replacement of the clamps to ensure acceptable clamp preload.	Procedure tracking the cumulative EFPY values to be enhanced no later than six months prior to the period of extended operation. For the analysis option, if selected, the revised analysis must be submitted to the NRC for review at least 2 years prior to exceeding 50.7 EFPY. For the repair or replacement options, if selected, repair or replacement must be implemented prior to exceeding 50.7 EFPY.	Section A.4.2.10 Exelon Letter RS-15-232 09/15/2015 Exelon Letter RS-16-003 01/07/2016 Exelon Letter RS-16-033 02/01/2016
48	Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program	Unit 2 Inspection of ASME Code Class 1 Small-Bore Piping Program is a new condition monitoring program that will manage the aging effect of cracking in ASME Code Class 1 small-bore piping that is less than nominal pipe size (NPS) 4-inches, and greater than or equal to NPS 1-inch.	Program to be implemented no later than six months prior to the period of extended operation. The one-time inspections and the first set of periodic inspections will be performed within the six years prior to the period of extended operation, and will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.	Section A.2.2.2 Exelon Letter RS-15-193 08/06/2015 Exelon Letter RS-16-003 01/07/2016

APPENDIX B

CHRONOLOGY

B. Chronology

This appendix lists chronologically the routine licensing correspondence between the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff) and Exelon Generation Company, LLC (Exelon or the applicant). This appendix also lists other correspondence on the staff's review of the LaSalle County Station, Units 1 and 2 (LSCS), license renewal application (LRA) (under Docket Nos. 50-373 and 50-374).

Date	Subject
December 9, 2014	LaSalle County Station, Units 1 and 2 (LSCS) – Application for Renewed Operating Licenses (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14343A840)
December 9, 2014	LaSalle, Units 1 and 2 - License Renewal Application, Title Page – Section 3, Table 3.4.2-5 (ADAMS Accession No. ML14343A841)
December 9, 2014	LaSalle, Units 1 and 2 - License Renewal Application, Section 3.5 – End (ADAMS Accession No. ML14343A842)
December 11, 2014	Letter to Gallagher, M.G., Exelon. Subject: Receipt and Availability of the License Renewal Application for LaSalle County Station, Units 1 and 2 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML14337A267)
December 18, 2014	*Federal Register* Notice – Notice of Receipt and Availability of the LaSalle County Station, Units 1 and 2, License Renewal Application (FRN 2014-75598) (ADAMS Accession No. ML14336A372)
January 26, 2015	Letter to Gallagher, M.G., Exelon. Subject: Determination of Acceptability and Sufficiency for Docketing, and Opportunity for Hearing (ADAMS Accession No. ML15021A451)
February 3, 2015	*Federal Register* Notice – Opportunity to Request a Hearing and Petition for Leave to Intervene (FRN 80 FR 5822) (ADAMS Accession No. ML15020A430)
February 20, 2015	License Renewal Application Environmental Review Scoping Meetings for LaSalle County Station, Units 1 and 2 (ADAMS Accession No. ML15058A275)
March 10, 2015	Transcript of Public Meeting RE License Renewal Application of LaSalle, Units 1 and 2, Afternoon Session, March 10, 2015, Pages 1 – 63 (ADAMS Accession No. ML15083A538)
March 10, 2015	Transcript of Public Meeting RE License Renewal Application of LaSalle, Units 1 and 2, Evening Session, March 10, 2015, Pages 1 – 55. (ADAMS Accession No. ML15089A580)
March 27, 2015	Letter to Gallagher, M.G., Exelon. Subject: Corrected: Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Exelon Generation Company, LLC, for Renewal of the Operating Licenses for LaSalle County Station, Units 1 and 2 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15030A320)
March 30, 2015	LaSalle County Station, Units 1 and 2 License Renewal Application Online Reference Portal (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15082A058)
April 1, 2015	Meeting Summary: Public Scoping Meetings for Environmental Review of LaSalle County Station (LSCS) Units 1 and 2, License Renewal Application (LRA) (TAC Nos. MF5567 AND MF5568) (ADAMS Accession No. ML15091A329)
May 8, 2015	Report: Scoping and Screening Methodology Report Regarding LaSalle County Station, Units 1 and 2 (ADAMS Accession No. ML15104A782)
May 14, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 1 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15111A137)
May 29, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 2 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15125A198)

Date	Subject
June 8, 2015	Response to NRC Requests for Additional Information, Set 1, dated May 14, 2015, related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15159A980)
June 8, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 3 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15131A413)
June 8, 2015	Summary of Telephone Conference Call Held on May 12, 2015, Between the U.S. Nuclear Regulatory Commission and Exelon Generation Co., LLC, Concerning Requests for Additional Information, Set 1 Pertaining To the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15140A093)
June 8, 2015	Summary of Telephone Conference Call Held on May 13, 2015, Between the U.S. Nuclear Regulatory Commission and Exelon Generation Co., LLC, Concerning Requests for Additional Information, Set 2 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15140A192)
June 19, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 4 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15146A262)
June 25, 2015	Response to NRC Requests for Additional Information, Set 2, dated May 29, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15176A348)
July 1, 2015	Response to NRC Requests for Additional Information, Set 3, dated June 8, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15182A337)
July 6, 2015	Summary of Telephone Conference Call Held on May 20, 2015, Between the U.S. Nuclear Regulatory Commission and Exelon Generation Co., LLC, Concerning Requests for Additional Information, Set 3 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15159A900)
July 7, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 5 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15159A208)
July 7, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 6 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15163A071)
July 15, 2015	Response to NRC Requests for Additional Information, Set 4, dated June 19, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15196A421)
July 16, 2015	Request for Schedule Change Related to Advisory Committee on Reactor Safeguards (ACRS) Subcommittee Review of LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15197A206)
July 27, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Applicatio4
August 6, 2015	Response to NRC Requests for Additional Information, Set 5, dated July 7, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15218A421)
August 6, 2015	Response to NRC Requests for Additional Information, Set 6, dated July 7, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15218A424)
August 18, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 9 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15204A630)

Date	Subject
August 26, 2015	Response to NRC Requests for Additional Information, Set 7, dated July 27, 2015; and a Correction to Information associated with the Set 2 response to RAI 8.2.1.20-2, related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15238B621)
August 27, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 10 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15229A019)
August 28, 2015	Summary of Telecon Held on June 3, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 4 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15217A564)
August 28, 2015	Summary of Telecon Held on June 10, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 4 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15217A575)
August 28, 2015	Summary of Telecon Held on June 9, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 5 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15217A541)
August 28, 2015	Summary of Telecon Held on June 23, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 6 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15219A277)
August 28, 2015	Summary of Telecon Held on July 8, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 7 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15222A015)
August 28, 2015	Summary of Telecon Held on July 22, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 8 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15222A008)
August 28, 2015	Summary of Telecon Held on August 11, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 9 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15224A935)
August 28, 2015	Summary of Telecon Held on August 5, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning Request for Additional Information Set 9 Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15222A006)
August 28, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 8 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15195A338)
September 14, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 11 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15244B353)
September 15, 2015	Response to NRC Requests for Additional Information, Set 9, dated August 18, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15258A305)
September 17, 2015	Response to NRC Requests for Additional Information, Set 10, dated August 27, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15260A319)
September 22, 2015	Letter to Gallagher, M.P., Exelon. Subject: Aging Management Programs Audit Report Regarding LaSalle County Station, Units 1 and 2 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15196A045)

Date	Subject
September 22, 2015	Report: Aging Management Programs Audit Report Regarding LaSalle County Station, Units 1 and 2 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15196A115)
September 28, 2015	Response to NRC Requests for Additional Information, Set 8, dated August 28, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15271A341)
October 8, 2015	Response to NRC Request for Additional Information, Set 11, dated September 14, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15281A319)
October 22, 2015	Schedule Revision for the Review of the LaSalle County Station, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15208A052)
October 23, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 12 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15271A021)
October 29, 2015	Response to NRC Requests for Additional Information, Set 12, dated October 23, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15302A493)
November 3, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 13 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15300A366)
November 18, 2015	LaSalle County Station, Units 1 and 2 License Renewal Scoping, Screening, and Aging Management Inspection Report 05000373/2015008; 05000374/2015008 (ADAMS Accession No. ML15323A064)
December 2, 2015	10 CFR 54.21(b) Annual Amendment to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15336A288)
December 2, 2015	Corrections to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15336A220)
December 10, 2015	Response to NRC Requests for Additional Information, Set 13, dated November 3, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15344A347)
December 11, 2015	Summary of Teleconference Held on September 24, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning RAI Set 10 Response Pertaining to the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15272A400)
December 14, 2015	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 14 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15301A189)
January 7, 2016	Responses to NRC Requests for Additional Information, Set 14, dated December 14, 2015, and Two Additional Commitment Implementation Schedule Clarifications, related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML16007A130)
January 7, 2016	Summary of Teleconference Held on December 22, 2015, Between the NRC and Exelon Generation Co., LLC, Concerning the LaSalle County Station License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15357A281)
January 14, 2016	Supplemental Information Associated With Implementation of BWRVIP-25, "Core Plate Inspection and Flaw Evaluation Guidelines," Related To the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 AND MF5346) ADAMS Accession No. ML16014A173)
January 29, 2016	Summary of Teleconference Held on January 21, 2016, Between the U.S. Nuclear Regulatory Commission and Exelon Generation Co., LLC, Concerning RAI 4.2.10-1 Response Pertaining to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML16021A325)

Date	Subject
February 1, 2016	Update to Commitment 47 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 AND MF5346) (ADAMS Accession No. ML16032A381)
February 16, 2016	Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 15 (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML15344A354)
February 25, 2016	Response to NRC Requests for Additional Information, Set 15, dated February 16, 2016 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML16056A232)
February 29, 2016	Safety Evaluation Report With Open Items Related to the License Renewal of LaSalle County Station, Units 1 and 2 (ADAMS Accession No. ML16053A439)
April 4, 2016	Exelon Generation Company, LLC Comments on the Safety Evaluation Report with Open Items, related to the LaSalle County Station, Units 1 and 2 License Renewal Application (ADAMS Accession No. ML16095A273)
April 13, 2016	Supplemental information associated with NRC issuance of LR-ISG-2015-01, “Changes to Buried and Underground Piping and Tank Recommendations,” related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346) (ADAMS Accession No. ML16104A114)

APPENDIX C

PRINCIPAL CONTRIBUTORS

C. Principal Contributors

This appendix lists the principal contributors for the development of this safety evaluation report (SER) and their areas of responsibility.

Name	Responsibility
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Buford, Angela	Reviewer – Structural
Casto, Greg	Management Oversight
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Dennig, Robert	Management Oversight
Diaz-Sanabria, Yoira	Management Oversight
Doutt, Cliff	Reviewer – Electrical
Facco, Giovanni	Reviewer – Mechanical and Materials
Fitzpatrick, Robert	Reviewer – Scoping and Screening
Fu, Bart	Reviewer – Mechanical and Materials
Gardner, William (Tony)	Reviewer – Mechanical and Materials
Gavula, James	Reviewer – Mechanical and Materials
Gettys, Evelyn	Reviewer – Electrical
Hardgrove, Matthew	Reviewer – Scoping and Screening
Hiser, Allen	Senior Technical Advisor
Holston, William	Reviewer – Mechanical and Materials
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Hovanec, Christopher	Reviewer – Mechanical and Materials
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Reddy, Devender	Reviewer – Scoping and Screening
Rogers, Bill	Reviewer – Scoping and Screening Methodology
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APPENDIX D

REFERENCES

D. References

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application for LaSalle County Station, Units 1 and 2 (LSCS).

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The staff reviewed the following website: http://www.tubes-international.com/tygon_tubing.html.