Safety Evaluation Report

Related to the License Renewal of Waterford Steam Electric Station Unit 3

Docket No. 50-382

Entergy Operations, Inc.

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Waterford Steam Electric Station Unit 3 (WF3) license renewal application (LRA) by the United States (U.S.) Nuclear Regulatory Commission (NRC) staff (the staff).

By letter dated March 23, 2016, (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML16088A324), Entergy Operations, Inc. (Entergy 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.” Entergy requests renewal of the WF3 operating license (Operating License No. NPF-38) for a period of 20 years beyond the current expiration at midnight on December 18, 2024.

WF3 is located in Killona, Louisiana. The NRC issued the WF3 construction permit (CPPR-103) on November 14, 1974, and the operating license on March 16, 1985. WF3 is a pressurized-water reactor designed by Combustion Engineering. WF3 has a licensed power output of 3,716 megawatts thermal.

This SER presents the status of the staff’s review of information submitted through June 26, 2018. There are no open items that remain to be resolved. Based on review of the LRA, the staff determines that the requirements of 10 CFR 54.29(a) have been met (see Section 5).

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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
ACC	auxiliary component cooling water
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor steel reinforced
ADAMS	Agencywide Documents Access and Management System
ADG	auxiliary diesel generator
ADS	automatic depressurization system
AE	air evacuation
AEM	aging effect/mechanism
AERM	aging effect requiring management
AFW	auxiliary feedwater
Al	aluminum
AMP	aging management program
AMR	aging management review
ANP	annulus negative pressure
ANSI	American National Standards Institute
ARM	area radiation monitoring
ARR	airborne radioactivity removal
ART	adjusted reference temperature
AS	auxiliary steam
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
BAM	boric acid makeup
BD	blowdown
BM	boron management
BTP	Branch Technical Position
BWR	boiling-water reactor
C	centigrade
CAP	containment atmosphere purge
CAR	condenser and air removal
CAS	compressed air system
CASS	cast austenitic stainless steel
CB	containment building
CB&I	Chicago Bridge and Iron Company
CCS	containment cooling HVAC system
CCWS	component cooling water system
CD	condensate
CE	Combustion Engineering
CEA	control element assembly
CECo	Commonwealth Edison Company

CED	control element drive
CEDM	control element drive mechanisms
CEOG	Combustion Engineering Owners Group
CF	chemical feed
CFR	*Code of Federal Regulations*
CGC	combustible gas control
CHRE	Cranes, Hoists and Refueling Equipment
CII	containment inservice inspection
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CMTR	certified material test report
CMU	condensate makeup and storage
CO_2	carbon dioxide
CRD	control rod drive
CRDRL	control rod drive return line
CRV	control room ventilation
CS	containment spray, core shroud
CSCS	core standby cooling system
CSP	condensate storage pool
Cu	copper
CUF	cumulative usage factor
CUF_{en}	environmentally adjusted cumulative usage factor
CVAS	controlled ventilation area system
CVC	chemical and volume control
CVR	containment vacuum relief
CW	circulating water
DBA	design basis accident
DBE	design basis event
DC	direct current
DCT	dry cooling tower
DGA	diesel generator and auxiliaries
DPS	drywell pneumatic system
∆RT	reference temperature change
EAF	environmentally assisted fatigue
EBA	emergency breathing air
ECCS	emergency core cooling system
EDG	emergency diesel generator
EFPY	effective full-power year
EFW	emergency feedwater
EN	enclosure protection
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
Ext	external
FAC	flow-accelerated corrosion

FASA	focused area self-assessment
FB	fire barrier
FC	flow control
FD	flow distribution
F_{en}	environmentally assisted fatigue correction factor
FERC	Federal Energy Regulatory Commission
FHS	fuel handling and storage
FLB	flood barrier
FPR	fire protection report
FR	*Federal Register*
FS	fuel pool cooling and purification
FSAR	final safety analysis report
ft	foot (feet)
ft-lb	foot-pound
FW	main feedwater
GALL	Generic Aging Lessons Learned [NUREG-1801] Report
GEIS	generic environmental impact statement
GL	generic letter
GSI	generic safety issue
GWM	gaseous waste management
H&V	heating and ventilation
HAZ	heat affected zone
HDPE	high density polyethylene
HELB	high-energy line break
HEPA	high efficiency particulate air
HPCS	high pressure core spray
HPSI	high-pressure safety injection
HRA	hydrogen recombiners and analyzers
HS	heat sink
HVAC	heating, ventilation, and air conditioning
HVC	control room heating, ventilation, and air conditioning
HVD	hot machine shop and decontamination facility ventilation
HVF	fuel handling building HVAC
HVR	reactor auxiliary building HVAC
HVT	turbine building ventilation
IA	instrument air
ICI	incore instrumentation
ICI/HJTC-CET	ICI/heated junction thermocouple-core exit thermocouples
ILRT	integrated leakage rate test
IN	insulation
INPO	Institute of Nuclear Power Operations
int	internal
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
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
INPO	Institute of Nuclear Power Operations
ISI	inservice inspection
ISP	integrated surveillance program
ksi	kilopound(s) per square inch
kV	kilovolt(s)
LAS	low alloy steel
lb	pound(s)
LBB	leak-before-break
LCO	limiting condition(s) of operation
LLRT	local leakage rate test
LOCA	loss-of-coolant accident
LPCI	low-pressure coolant injection
LPCS	low-pressure core spray
LPRM	local power range monitor
LPSI	low-pressure safety injection system
LR	license renewal
LRA	license renewal application
LREH	License Renewal Electrical Handbook
LR-ISG	license renewal interim staff guidance
LRT	leakage rate test
LTOP	low-temperature overpressure protection
μm	micrometer
MB	missile barrier
MEB	metal-enclosed bus
MeV	million electron-volt(s)
MIC	microbiologically-influenced corrosion
Mil	thousandth of an inch
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
MSL	mean sea level
MSLB	main steam line break
MTA	main turbine and auxiliaries
mV	millivolt(s)
MWe	megawatts-electrical
MWt	megawatts-thermal
N/A	neutron absorption Not Applicable

n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NG	nitrogen
Ni	nickel
NPIS	nuclear plant island structure
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
OBE	operating-basis earthquake
OE	operating experience
OI	Open Item
OVHLL	Overhead Heavy Load and Light Load
PB	pressure boundary
PCSR	permanent cavity seal ring
PCV	primary containment ventilation
pH	potential of hydrogen
PH	precipitation-hardened
PLL	predicted lower limit
PM	preventive maintenance
PMP	probable maximum precipitation
PMU	primary makeup
PRM	process radiation monitoring
psi	pound(s) per square inch
PSL	primary sampling
PSP	process sampling and post-accident monitoring
PSPM	periodic surveillance and preventive maintenance
psig	pound(s) per square inch (gauge)
P-T	pressure-temperature
PTLR	pressure-temperature limit report
PVC	polyvinyl chloride
PW	potable water
PWR	pressurized-water reactor
PWSCC	primary water stress corrosion cracking
PWST	primary water storage tank
QA	quality assurance
radwaste	radioactive waste
RAI(s)	request(s) for additional information
RAMA	Radiation Analysis Modeling Application
RAB	reactor auxiliary building
RC	reactor coolant
RCC	reactor cavity cooling
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
SA	service air
SAT	system auxiliary transformer
S&PC	steam and power conversion
SBA	small break accident
SBO	station blackout
SC	structure and component
SCC	stress corrosion cracking
SE	safety evaluation
SER	safety evaluation report
SG	steam generator
SGT	Standby Gas Treatment
SI	safety injection
SIS	safety injection system
SIT	safety injection tank
SLC	standby liquid control
SMAW	shielded metal-arc welding
S-N	stress versus number of cycles
SNS	support for Criterion (a)(2) equipment
SO_2	sulfur dioxide
SP	sump pump
SPC	Suppression Pool Cleanup
SRE	support for Criterion (a)(3) equipment
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
SS	stainless steel
SSC	system, structure, or component
SSE	safe-shutdown earthquake
SSR	support for Criterion (a)(1) equipment
STAMR	subject to aging management review
SVS	cable vault and switchgear ventilation
TBCCW	turbine building closed cooling water
TC	turbine building cooling water
TGB	turbine generator building
TIP	traversing incore probe
TLAA(s)	time-limited aging analysis(es)
TRM	Technical Requirements Manual
TS	Technical Specification(s)

TSP	trisodium phosphate dodecahydrate
TW	treated water
UFSAR	updated final safety analysis report
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet
V	volt
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 Waterford Steam Electric Station Unit 3 (WF3), as filed by Entergy Operations, Inc. (Entergy or the applicant). By letter dated March 23, 2016 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML16088A324), Entergy 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." Entergy requests renewal of the WF3 operating license (Operating License No. NPF-38) for a period of 20 years beyond the current expiration at midnight on December 18, 2024.

The NRC staff (the staff) performed a safety review of WF3's application for compliance with 10 CFR Part 54. The NRC project manager for the license renewal review is Ms. Phyllis Clark. Ms. Clark may be contacted by telephone at 301-415-6447 or by electronic mail at Phyllis.Clark@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of Materials and License Renewal
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Phyllis M. Clark, Mail Stop O11-F1

In its March 23, 2016, submission letter, the applicant requested renewal of the operating licenses issued under Section 103 (Operating License No. NPF-38) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), for WF3 for a period of 20 years beyond the current expiration at midnight on December 18, 2024.

WF3 is located in Killona, Louisiana. The WF3 design includes a Combustion Engineering pressurized-water reactor (PWR) nuclear steam supply system with licensed thermal power of 3,716 megawatts thermal. The NRC issued the construction permit for Unit 3 on November 14, 1974. The NRC issued the initial operating license for Unit 3 on March 16, 1985. The updated final safety analysis report (UFSAR) shows details of the plant and the site.

The license renewal process consists of two concurrent reviews, a review of the safety issues and an environmental review. The NRC regulations in 10 CFR Part 54 and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," respectively, set forth requirements for these reviews. The safety review for the WF3 license renewal is based on the applicant's LRA, the staff's audits, and Entergy's 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 questions in audits, public meetings, and docketed correspondence. The staff reviewed and considered information submitted through June 26, 2018. 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). The LRA may also be viewed at the St. Charles Parish Emergency Operations

Center in Hahnville, Louisiana. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC website at http://www.nrc.gov.

This SER summarizes the results of the staff's LRA safety review and describes the technical details considered in evaluating the safety aspects of the WF3 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 license. SER Appendix B is a chronology of the principal correspondence between the staff and the applicant regarding the LRA review. SER Appendix C is a list of principal contributors to the SER, and Appendix D is a bibliography of the references in support of the staff's review.

In accordance with 10 CFR Part 51, the staff prepared a draft plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." The staff will issue the draft, plant-specific GEIS Supplement 59, "Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants, Supplement 59, Regarding Waterford Steam Electric Station Unit 3, Draft Report for Comment," in August 2018. This supplement discusses the environmental considerations for license renewal of WF3.

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 (IPA) 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.

As required by 10 CFR 54.21(a), an applicant for a renewed license 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 a change in configuration or properties (i.e., are “passive”) and are not subject to replacement based on a qualified life or specified time period (i.e., are “long-lived”). As required by 10 CFR 54.21(a), an applicant for a renewed license must demonstrate that the aging effects will be managed so that the intended functions of those SSCs will be maintained consistent with the current licensing basis (CLB) for the period of extended operation; however, active equipment is considered adequately monitored and maintained by existing programs. In other words, the applicant must show that 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 issued Regulatory Guide (RG) 1.188, Revision 1, "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 in June 2005 by NEI. 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 processes defined in NEI 95-10, Revision 6, "Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule," dated June 2005; NUREG-1800, Revision 2, "Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants," dated December 2010; and 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. An applicant's willingness to commit to carrying out these staff-approved AMPs could potentially reduce the time, effort, and resources in reviewing an applicant's LRA and, thereby, improve the efficiency and effectiveness of the license renewal review process. The report is also a reference for both applicants and the staff to use to identify AMPs and activities that can provide adequate aging management during the period of extended operation. It is incumbent on the applicant to ensure that the conditions and operating experience at the plant are bounded by the conditions and operating experience for which the GALL Report was evaluated. If these bounding conditions are not met, the applicant should address the additional effects of aging and augment its AMP as appropriate.

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 into 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 (78 FR 37282), the 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 (78 FR 37325). 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 (NEPA) 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 June 8, 2016, at the St. Charles Parish Emergency Operations Center in Hahnville, Louisiana, to identify plant-specific environmental issues. The draft, plant-specific GEIS Supplement 59 documents the results of the environmental review and makes a preliminary recommendation on the license renewal action. After considering comments received on the draft during the public comment period, the staff will publish the final, plant-specific GEIS Supplement 59 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 LRA technical review 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 provides 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 54.19(b) requires that license renewal applications include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current Indemnity Agreement (No. B-92) for Waterford Steam Electric Station, Unit 3, states in Article VII that the Agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment (to the Agreement), which is the last to expire. Item 3 of the Attachment to the Indemnity Agreement, as revised through Amendment No. 7, lists Waterford 3 facility operating license number NPF-38. Entergy has reviewed the original Indemnity Agreement and the Amendments. Neither Article VII nor Item 3 of the Attachment specifies an expiration date for license number NPF-38. Therefore, no changes to the

Indemnity Agreement are deemed necessary as part of this application. Should the license number be changed by NRC upon issuance of the renewed license, Entergy requests that NRC amend the Indemnity Agreement to include conforming changes to Item 3 of the Attachment and other affected sections of the Agreement.

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 IPA, (b) a description of any CLB changes during the staff's LRA review, (c) an evaluation of TLAAs, and (d) an FSAR supplement. LRA Sections 3 and 4 and Appendices A and B address the license renewal requirements of 10 CFR 54.21(a), (c), and (d).

In accordance with 10 CFR 54.21(b), the NRC requires that, each year following the LRA submission and at least 3 months before the scheduled completion of the staff's review, the applicant must submit an LRA amendment identifying any CLB changes to the facility that affect the LRA contents, including the FSAR supplement. By letter dated November 15, 2017, the applicant submitted an LRA update that summarized the CLB changes that had occurred during the staff's LRA review. This submission was 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 (TS) necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that a review of the information in this LRA and the WF3 TS determined no changes to the TS are required. 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 1.1-1 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 and revises Table 1 items to include One Time Inspection of SS components in treated borated water.	Tables 3.2-1 and 3.3-1
"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 applicant's steam generator AMP.	Section 3.0.3.1.17
"Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, 'Buried and Underground Piping and Tanks'" (LR-ISG-2011-03)	This LR-ISG provides additional guidance on managing the effects of aging on buried and underground piping and tanks.	Sections 3.0.3.1.2, 3.0.3.1.16, 3.0.3.2.1, and 3.0.3.2.6
"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.	Section 3.1.2.2 and Table 3.1-1
"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.	Section 3.0.5
"Wall Thinning Due to Erosion Mechanisms" (LR-ISG-2012-01)	This LR-ISG provides additional guidance on managing the effects of wall thinning due to erosion mechanisms.	Sections 3.0.3.2.10, 3.3.2.1.18, and 3.4.2.3.4
"Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation" (LR-ISG-2012-02)	This LR-ISG provides guidance on managing the effects of aging for internal surfaces, fire water system, atmospheric storage tanks, and corrosion under insulation.	Sections 3.0.3.1.6, 3.0.3.2.6, 3.0.3.2.9, 3.0.3.2.19, 3.0.3.2.21, 3.2.2.2.9, 3.3.2.1.10, 3.3.2.1.12, 3.3.2.2.8, 3.3.2.3.3, 3.3.2.3.7, and 3.4.2.2.6
"Aging Management of Loss of Coating or Lining Integrity for Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" (LR-ISG-2013-01)	This LR-ISG provides guidance on aging management for coating or lining integrity for internal coatings/linings on in-scope piping, piping components, heat exchangers, and tanks.	Sections 3.0.3.2.2, 3.0.3.2.9, and 3.3.2.3.7
"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.	Section 3.0.3.1.2

ISG Issue (Approved ISG Number)	Purpose	SER Section
“Changes to Aging Management Guidance for Various Steam Generator Components” (LR-ISG-2016-01)	This LR-ISG addresses the changes to aging management guidance regarding cracking due to primary water stress corrosion cracking (PWSCC) of divider plate assemblies and tube-to-tubesheet welds, and loss of material due to boric acid corrosion of steam generator heads and tubesheets.	Sections 3.0.3.1.17 and 3.1.2.2.11

1.5 Summary of Open Items

As a result of its LRA review, including additional information submitted through June 26, 2018, the staff identified no open items that 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.

1.6 Summary of Confirmatory Items

As a result of its LRA review, including additional information submitted through June 26, 2018, 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 LRA review, including subsequent information and clarifications from the applicant, the staff identified two proposed license conditions.

(1) The information in the Final Safety Analysis Report (FSAR) supplement submitted as required by 10 CFR 54.21(d) and revised during the application review process, and the licensee commitments listed in Appendix A of the Safety Evaluation Report Related to the License Renewal of Waterford Steam Electric Station, Unit 3 (Waterford 3) dated [date], is collectively the “License Renewal FSAR Supplement.” This Supplement is henceforth part of the FSAR which will be updated in accordance with 10 CFR 50.71(e). As such, Entergy Operations, Inc., and Entergy Louisiana, LLC, (collectively Entergy) may make changes to the programs and activities applicable to Waterford 3 described in this Supplement provided Entergy evaluates such changes in accordance with the criteria set forth in 10 CFR 50.59 “Changes, Tests and Experiments,” and otherwise complies with the requirements in that section.

(2) This License Renewal FSAR Supplement, as specified in License Condition [1] above, describes programs to be implemented and activities to be completed before the period of extended operation (PEO).

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

   b) The applicant shall complete those activities by the date 6 months before the PEO or by the end of the last refueling outage before 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.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Title 10, Section 54.21, "Contents of Application - Technical Information," of the *Code of Federal Regulations* (10 CFR 54.21) 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) that identifies and lists those structures and components (SCs), contained in the SSCs 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 Entergy Operations, Inc., and Entergy Louisiana, LLC, (Entergy, the applicant) to identify the SSCs at Waterford Steam Electric Station Unit 3 (WF3) 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 contained in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), Section 2.1, "Scoping and Screening Methodology." The following regulations provide the basis for the acceptance criteria used by the staff to assess the adequacy of the scoping and screening methodology that the applicant used 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 the applicant used to identify plant 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 WF3 facility located in St. Charles Parish, Louisiana, during the week of June 13-16, 2016. 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 described 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 the applicant used 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 documentation and supporting current licensing basis (CLB) information for portions of the essential cooling water system and nuclear plant island structure. 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 provided guidance on the review and consideration of CLB documentation sources, relative to the requirements of 10 CFR 54.4 and 10 CFR 54.21.

LRA Section 2.1 listed the following information sources for the license renewal scoping and screening process:

- WF3 equipment database
- final safety analysis report (FSAR)
- maintenance rule documentation
- design basis documents
- post-fire safe shutdown analysis
- station drawings

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 the guidance is consistent with the requirements of the Rule, the SRP-LR and Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Plant Operating Licenses," 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 the staff's positions documented in the SRP-LR, and the information in the applicant's response dated November 10, 2016, to the staff's request for additional information (RAI), dated October 12, 2016. After reviewing the LRA and supporting documentation, and the RAI response, the staff determined that the scoping and screening methodology instructions are consistent with the methodology description provided in LRA Section 2.1 and are sufficiently detailed in the implementing procedures to provide concise guidance on the scoping and screening process to be followed during the LRA activities.

<u>Sources of Current Licensing Basis Information.</u> 10 CFR 54.21(a)(3) requires, for each structure and component (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. 10 CFR 54.3(a) defines the CLB, in part, as the set of NRC requirements applicable to a specific plant and an applicant'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, TS, and design basis information (documented in the most recent FSAR). The CLB also includes applicant commitments remaining in effect that were made in docketed licensing correspondence, such as applicant responses to NRC bulletins, generic letters, and enforcement actions, and applicant commitments documented in NRC safety evaluations or applicant 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 requiring 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 the applicant used, including the WF3 equipment database, the FSAR, maintenance documentation, design basis documents, the post-fire safe shutdown analysis and station drawings.

During the audit, the staff discussed the applicant's administrative controls for the equipment 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 staff determined that the applicant has established adequate measures to control the integrity and reliability of system identification and safety classification data. The staff determined that the information sources the applicant used 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 documentation 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 documentation sources, required to be used by the applicant's implementing procedures, 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 and 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 the applicant used to ensure that the scoping and screening methodology used to develop the LRA were adequate for the activity. The applicant used the following quality control processes during the LRA development:

- License renewal team coordination and review of all license renewal activities
- Procedural control of LRA development
- Subject matter experts, supervisor and manager preparation and review of implementing documents, scoping and screening results documentation and the LRA
- Industry peer review of the draft LRA

The staff performed a review of implementing procedures and guides, examined the applicant's documentation of activities, reviewed the applicant's activities performed to assess the LRA's quality, and held discussions with the applicant's license renewal management and staff. The audit team 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

Based on its review of pertinent LRA development guidance and the review of the applicant's documentation of the activities performed to assess the LRA's quality, the staff concludes that the applicant's quality assurance activities were 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 that the applicant used for license renewal project personnel to confirm that it was appropriate for the activity. As specified by the license renewal

implementing procedures, the applicant had required training and qualification of personnel performing activities supporting the LRA development, including identification of SSCs within the scope of license renewal, identification of SCs subject to an AMR and documenting the information in reports.

Training included the following topics and activities:

- License renewal overview
- WF3 License Renewal Project Plan
- System and structure scoping
- Mechanical system screening and AMR
- Structural screening and AMR
- Electrical system screening and AMR
- Evaluation of aging management programs
- Time-limited aging analysis and exemptions evaluation
- License renewal application development
- Operating experience review for license renewal
- Industry guidelines for implementation of 10 CFR Part 54
- Regulatory Guide 1.188, Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses
- NUREG-1800 - NRC Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
- NUREG-1801 - NRC Generic Aging Lessons Learned (GALL) Report

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

Based on 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

Based on the 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 described 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, are nonsafety-related whose failure could prevent accomplishment of a safety-related function, or support a specific requirement for one of the regulated events applicable to license renewal. 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 included within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a)(1) in LRA Section 2.1.1.1, "Application of Safety-Related Scoping Criteria," which states:

> A system or structure is within the scope of license renewal if it performs a safety function during and following a design basis event as defined in 10 CFR 54.4(a)(1). Design basis events are defined in 10 CFR 50.49(b)(1)(ii) as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions identified in 10 CFR 54.4(a)(1)(i) through (iii).
>
> An Entergy corporate procedure and a site engineering standard provide control of component and structure quality classification.

In addition, LRA Section 2.1.1.1 states that the definition of "safety-related" contained in the Entergy corporate procedure used during LRA development was equivalent to the definition in 10 CFR Part 54. LRA 2.1.1.1 also states that the original definition of safety-related, used in the original WF3 specification, was different than the Entergy corporate definition and was reconciled by the applicant as follows:

> The original specifications for Waterford 3 used a somewhat different definition for Safety Class 3 for equipment whose failure would "result in significant release of radioactivity to the environment." Use of the term "significant release" instead of the requirements of 50.34(a)(1), 50.67(b)(2), or 100.11 resulted in components that are classified as Safety Class 3 at Waterford 3 but do not meet the criteria of 10 CFR 54.4(a)(1). Waterford 3 Safety Class 3 components were evaluated to determine if they supported system functions meeting the requirements of 10 CFR 54.4(a)(1). Those that did not were further evaluated for the criteria of 10 CFR 54.4(a)(2) and (a)(3).

2.1.4.1.2 Staff Evaluation

In accordance with the requirements of 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a design basis event (DBE) to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary, (2) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or Part 100.11, 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 upon 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 WF3. The staff reviewed the applicant’s basis documents which described design basis conditions in the CLB and addressed events defined by 10 CFR 50.49(b)(1) and 10 CFR 54.4(a)(1). The FSAR and basis documents discussed events such as internal and external flooding, tornados, and missiles. The staff concludes that the applicant’s evaluation of DBEs was consistent with the SRP-LR.

The 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 that 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 documentation 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 the evaluations.

The staff reviewed the applicant’s evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1) and the applicant’s reconciliation of the Waterford Safety Class 3 designation with the requirements of 10 CFR 54.4(a)(1) for the purpose of identifying safety-related SSCs within the scope of license renewal. The staff determined that the applicant’s CLB definition of safety-related and the results of the applicant’s reconciliation of the Waterford Safety Class 3, as applied during LRA development, met the definition of safety-related specified in the Rule.

The staff reviewed a sample of the license renewal scoping results for portions of the essential cooling water system and the nuclear plant island structure to provide additional assurance that

the applicant adequately implemented their scoping methodology with respect to 10 CFR 54.4(a)(1). The staff confirmed that the applicant had developed the scoping results for each of the sampled systems consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results, as well as the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal in accordance with the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.3 Conclusion

Based on the review of the LRA and the applicant's implementing procedures and documentation, and reviews of a system on a sampling basis, the staff concludes that the applicant's methodology for identifying safety-related SSCs relied upon to remain functional during and following design basis events and 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

LRA Section 2.1.1.2, “Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions,” 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 2.1.1.2.1, “Functional Failures of Nonsafety-Related SSCs,” states:

> At Waterford 3, with few exceptions, systems and structures required to perform a function to support a safety function are classified as safety-related and have been included in the scope of license renewal per Section 2.1.1.1. For the few exceptions where nonsafety-related equipment is required to remain functional to support a safety function (e.g., the dry cooling tower sump pumps, makeup to spent fuel pool), the system containing the equipment has been included in scope, and the function is listed as an intended function for 10 CFR 54.4(a)(2) for the system. Flooding analyses were reviewed to determine systems with functions credited to mitigate effects of external or internal flooding.

LRA Section 2.1.1.2.2(1), “Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs,” states:

> For nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems), components within the scope of license renewal include the nonsafety-related piping, components and supports up to and including the first seismic or equivalent anchor or base-mounted component beyond the safety-to-nonsafety interface such that the safety-related portion of the piping will be able to perform its intended function.

LRA Section 2.1.1.2.2(2), “Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs,” Part (c), “Leakage or Spray,” states, in part:

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

The review used a spaces approach for scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs. The spaces approach focuses on the interaction between nonsafety-related and safety-related SSCs that are located in the same space. A "space" is defined as a room or cubicle that is separated from other spaces by substantial objects (such as wall, floors, and ceilings). The space is defined such that any potential interaction between nonsafety-related and safety-related SSCs, including flooding, is limited to the space.

Nonsafety-related systems that contain water, oil, or steam with components located inside structures containing safety-related SSCs are potentially in scope for possible spatial interaction under criterion 10 CFR 54.4(a)(2). These systems were evaluated further to determine if system components were located in a space such that safety-related equipment could be affected by a component failure.

2.1.4.2.2 Staff Evaluation

RG 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 preventive options related to nonsafety-related and safety-related SSCs interactions. LRA Section 1.5 states that the applicant’s methodology is consistent with the guidance contained in NEI 95-10, Revision 6, Appendix F.

In addition, the staff’s position (as discussed in the SRP-LR Section 2.1.3.1.2) is that applicants should not consider hypothetical failures, but rather should base their evaluation on the plant’s CLB, engineering judgment and analyses, and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports such as safety operational event reports, and engineering evaluations. The staff reviewed LRA Section 2.1.1.2 and subsections in which the applicant described the scoping methodology for nonsafety-related SSCs in accordance with 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant’s implementing procedure and results report, which documented the guidance and corresponding results of the applicant’s scoping review as required by 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC Intended Function.

The staff reviewed LRA Section 2.1.1.2.1, “Functional Failures of Nonsafety-Related SSCs,” and the applicant’s 10 CFR 54.4(a)(2) implementing procedure that described the method used to identify nonsafety-related SSCs, 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 FSAR, plant drawings, the equipment database, and other CLB documents to identify the nonsafety-related systems and structures that function to support a safety-related system or whose failure could prevent the performance of a safety-related intended function. The staff determined that the applicant had identified nonsafety-related SSCs that perform a function that supports a safety-related intended function and included those nonsafety-related SSC 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 SRP-LR guidance and the requirements of 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs.

The staff reviewed LRA Section 2.1.1.2.2(1) and the applicant's 10 CFR 54.4(a)(2) implementing procedure that described the method used to identify nonsafety-related SSCs, directly connected to safety-related SSCs, and include the nonsafety-related SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant had reviewed the safety-related to nonsafety-related interfaces for each mechanical system in order to identify the nonsafety-related components located between the safety-related or nonsafety-related interfaces up to and including an identified license renewal structural anchor or bounding condition.

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

- Seismic anchors
- Equivalent anchors (restraints or supports)
- Bounding conditions as described in NEI 95-10 Revision 6, 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 seven 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 SRP-LR guidance 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 2.1.1.2.2(2), Part (c), and the applicant's 10 CFR 54.4(a)(2) implementing procedure that described 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 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 room or cubicle that is separated from other spaces by substantial objects (such as wall, floors, and ceilings).

The staff determined that the applicant had identified all nonsafety-related SSCs, containing liquid or steam, and located in spaces containing safety-related SSCs. The applicant had included the nonsafety-related SSCs within the scope of license renewal, unless an evaluation was performed and it was determined that the failure of the nonsafety-related SC would not result in the loss of a 10 CFR 54.4(a)(1) intended function. The staff also determined that, based on plant and industry operating experience, the applicant excluded the nonsafety-related SSCs containing air or gas from the scope of license renewal, with the exception of portions that are attached to safety-related SSCs and required for structural support.

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 SRP-LR guidance and the requirements of 10 CFR 54.4(a)(2).

2.1.4.2.3 Conclusion

Based on the review of the LRA and the applicant's implementing procedures and documentation, and selected system reviews and walkdowns, 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 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 2.1.1.3, "Application of Criterion for Regulated Events," states:

> The scope of license renewal includes those systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (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). This section discusses the approach used to identify the systems and structures within the scope of license renewal based on this criterion.

2.1.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1.3 that described the method used to identify and 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 NRC'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).

As part of this review, during the scoping and screening methodology audit the staff reviewed implementing procedures, CLB information, license renewal drawings, and scoping results documentation. The staff determined that the applicant had evaluated the CLB to identify SSCs that perform functions addressed in 10 CFR 54.4(a)(3) and included these SSCs within the scope of license renewal as documented in the scoping results documentation. 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 fire protection documents that described the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (Fire Protection – 10 CFR 50.48). The implementing procedure described a process that considered CLB information, including the FSAR and the Post-Fire Safe Shutdown Analyses. The staff reviewed applicable LRA portions, CLB information, and license renewal drawings, to verify that the appropriate SSCs were included within the scope of license renewal. Based on its review of the CLB documents and a sample of scoping results documentation, 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 (EQ)

The staff reviewed the applicant's implementing procedure that described the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (Environmental Qualification—10 CFR 50.49). The implementing procedure described a process that considered CLB information and used a bounding approach that included all plant electric and instrumentation and control (I&C) SSCs within the scope of license renewal. The staff reviewed applicable LRA portions, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. Based on its review of the CLB documents and a sample of scoping results documentation, 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).

Pressurized Thermal Shock

The staff reviewed the applicant's implementing procedure that described the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (Pressurized Thermal Shock – 10 CFR 50.61). The staff reviewed applicable LRA portions, CLB information, and license renewal drawings, to verify the appropriate SSCs were included within the scope of license renewal. Based on its review of the CLB information and a sample of scoping results documentation, the staff determined that the applicant's methodology was adequate for identifying SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3).

Anticipated Transient Without Scram (ATWS)

The staff reviewed the applicant's implementing procedure that described the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (Anticipated Transients Without Scram—10 CFR 50.62). The implementing procedure described a process that considered CLB information and used a bounding approach that included all plant electric and I&C SSCs within the scope of license renewal. The staff reviewed

the applicable LRA portions, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. Based on its review of the CLB documents and a sample of scoping results documentation, 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 (SBO)

The staff reviewed the applicant's implementing procedure that described the method used to identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(3) (Station Blackout—10 CFR 50.63). The implementing procedure described a process that considered CLB information and used a bounding approach that included all plant electrical and I&C SSCs within the scope of license renewal. The staff reviewed applicable LRA portions, CLB information, and license renewal drawings to verify that the appropriate SSCs were included within the scope of license renewal. Based on its review of the CLB documents and a sample of scoping results documentation, 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

Based on the review of the LRA and the applicant's implementing procedures and documentation, and reviews of systems on a sampling basis, the staff concludes that the applicant's methodology for identifying and including SSCs relied upon 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 2.1.1, "Scoping Methodology," which states:

> NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - License Renewal Rule*, provides industry guidance for determining what SSCs are within the scope of license renewal. The process used to determine the systems and structures within the scope of license renewal for Waterford 3 followed the recommendations of NEI 95-10.
>
> Consistent with NEI 95-10, the scoping process developed a list of plant systems and structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a). The Waterford 3 equipment database was used to identify the system codes in use at the plant. The equipment database is a controlled list of plant components, with each component assigned to one plant system code.

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 it met the requirements of 10 CFR 54.4. The applicant had developed implementing procedures that described the processes used to identify the systems and structures that are subject to 10 CFR 54.4 review and to determine if the system or structure performed intended functions consistent with the criteria of 10 CFR 54.4(a) and to document the activities in scoping results documentation. 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 in accordance with the implementing procedures. The scoping results documentation provides a description of the structure or system, including a 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 scoping results documentation 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 the review of the LRA and 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 2.1.1 states:

> For mechanical system scoping, a system is defined as the collection of components required to perform the system's functions. These components are identified in the equipment database, on flow diagrams, and in descriptions of the systems in maintenance rule scoping documents, design basis documents, and system training material.

LRA Section 2.1.1 also states:

> Intended functions for structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included the FSAR, design basis documents, maintenance rule scoping documents, the post-fire safe shutdown analysis, and, as necessary, system training materials and various station drawings.

2.1.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1, implementing procedures, equipment database information and the CLB information associated with mechanical scoping. The staff determined that the equipment database information, CLB information and the implementing procedure guidance the applicant used 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 procedure was consistent with the description provided in the LRA Section 2.1.1 and the guidance contained in the SRP-LR and was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping results documentation for portions of the essential cooling water system and the process used to identify mechanical components that met the scoping criteria of 10 CFR 54.4. The staff reviewed the implementing procedures, the applicable equipment database information and CLB 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 confirmed 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 confirmed the results in accordance with the implementing procedures. The staff confirmed that the applicant’s license renewal personnel verifying the results had performed independent reviews of the scoping results documentation 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 confirmed that the applicant had used the applicable equipment database information and CLB information in order to determine that systems and components were included within the scope of license renewal in accordance with the 10 CFR 54.4(a).

2.1.4.5.3 Conclusion

Based on the review of information contained in the LRA and implementing procedures and the sampling review of scoping results documentation, 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 2.1.1 states:

> As the starting point for structural scoping, a list of plant structures was developed from a review of plant layout drawings, the FSAR, maintenance rule

> documentation, and relevant design basis documents. The structures list includes structures that potentially support plant operations or could adversely impact structures that support plant operations (i.e., seismic II/I). In addition to buildings and facilities, the list of structures includes other structures that support plant operation (e.g., electrical manholes and foundations for freestanding tanks).

LRA Section 2.1.1 also states:

> Intended functions for structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included the FSAR, design basis documents, maintenance rule scoping documents, the post-fire safe shutdown analysis, and, as necessary, system training materials and various station drawings.

2.1.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1, implementing procedures and the CLB information associated with structural scoping. The staff determined that the CLB information and the implementing procedure guidance the applicant used 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 procedure was consistent with the description provided in the LRA Section 2.1.1 and the guidance contained in the SRP-LR and was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping results documentation for portions of the nuclear plant island structure and the process used to identify structural systems and components that met the scoping criteria of 10 CFR 54.4. The staff reviewed the implementing procedures, confirmed that the applicant had used pertinent CLB 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 confirmed the results in accordance with the implementing procedures. The staff confirmed that the applicant's license renewal personnel verifying the results had performed independent reviews of the scoping results documentation 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 confirmed that the applicant had used pertinent CLB information in order to determine that SCs were included within the scope of license renewal in accordance with 10 CFR 54.4(a). In addition, the staff performed a general walkdown of the exterior of site structures, and the interior portion of selected site structures.

The staff determined that additional information would be required to complete its review. RAI 2.1-1, dated October 12, 2016, which states, in part, that during the onsite scoping and screening methodology audit the staff determined that the nonsafety-related west side access facility, which is immediately adjacent to the safety-related reactor building, was not included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff requested that the applicant provide a basis for not including the west side access facility within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant responded to RAI 2.1-1, by letter dated November 10, 2016, which states, in part, that the west side access facility is adjacent to (though structurally separate from) the reactor building's exterior wall that was designed for impact loading attributable to tornado-generated missiles. The applicant's response further states that the impact loading on the reactor building because of the postulated collapse of the west side access facility is bounded by the loading from tornado-generated missiles, as described in FSAR Section 3.3.2.1.

The staff reviewed the applicant's response to RAI 2.1-1 and determined that the applicant provided a technical basis that indicated the failure of the nonsafety-related west side access facility would not impact the intended functions of the safety-related reactor building and, therefore, the nonsafety-related west side access facility was not required to be included within the scope of license renewal in accordance with 10CFR 54.4(a)(2). RAI 2.1-1 is resolved.

2.1.4.6.3 Conclusion

Based on the review of the LRA and implementing procedures, the sampling review of scoping results documentation, and the applicant's response to RAI 2.1-1, 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 2.1.1, "Scoping Methodology," states, in part:

> For the purposes of system level scoping, plant electrical and I&C systems as well as electrical and I&C components in mechanical systems are included within the scope of license renewal. Intended functions for electrical and I&C systems are not identified since this bounding scoping approach (i.e., all electrical and I&C components are included in scope by default) makes it unnecessary to determine if an electrical and I&C system has an intended function. Switchyard equipment, which is not part of the plant's electrical and I&C systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance.

LRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems," states, in part:

> As stated in Section 2.1.1, plant electrical and instrumentation and control (I&C) systems are included in the scope of license renewal as are electrical and I&C components in mechanical systems. The default inclusion of plant electrical and I&C systems in the scope of license renewal is the bounding approach used for the scoping of electrical systems.
>
> The basic philosophy used in the electrical and I&C components IPA is that components are included in the review unless specifically screened out. When used with the plant spaces approach, this method eliminates the need for unique identification of individual components and specific component locations. This assures components are not improperly excluded from an aging management review.

> The electrical and I&C IPA began by grouping the total population of components into commodity groups. The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified. During the IPA screening process, commodity groups and specific plant systems were eliminated from further review if they did not perform or support an intended function.

2.1.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.1.1, LRA Section 2.5, implementing procedures, and the CLB source information associated with electrical scoping. The staff determined that the CLB source information and implementing procedure guidance the applicant used 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 appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the bounding approach described in LRA Sections 2.1.1 and 2.5, and the guidance contained in the SRP-LR, and was adequately implemented. The staff determined that the applicant’s scoping included appropriate electrical and I&C components, and electrical and I&C components contained in mechanical or structural systems, within the scope of license renewal in accordance with 10 CFR Part 54.4.

2.1.4.7.3 Conclusion

Based on the review of the LRA and implementing procedures, and the sampling review of scoping results documentation, 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 and, therefore, is acceptable.

2.1.4.8 Scoping Methodology Conclusion

Based on its review of the LRA and implementing procedures, a sampling review of scoping results, and RAI responses, 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, PTS, EQ, ATWS and SBO. The staff concludes that the applicant’s methodology is consistent with the requirements of 10 CFR 54.4(a) and, therefore, is acceptable.

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

2.1.5.1.1 Summary of Technical Information in the Application

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. LRA Section 2.1.2, “Screening Methodology,” states:

NEI 95-10 (Ref. 2.1-6) provides industry guidance for screening structures and components to identify the passive, long-lived structures and components that support an intended function. The screening process for Waterford 3 followed the recommendations of NEI 95-10.

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

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

2.1.5.1.2 Staff Evaluation

As required by 10 CFR 54.21, each LRA must contain an IPA that identifies SCs within the scope of license renewal that are subject to an AMR. The IPA must identify components that perform an intended function without moving parts or a change in configuration or properties (passive), as well as components that are not subject to periodic replacement based on a qualified life or specified time period (long-lived). In addition, the IPA must include a description and justification of the methodology used to 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 the applicant used to identify the mechanical, structural, and electrical SSCs 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 documentation for the essential cooling water system and nuclear plant island structure. 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. The specific methodologies for mechanical, structural, and electrical SCs are discussed in safety evaluation report Sections 2.1.5.2 through 2.1.5.4

2.1.5.1.3 Conclusion

Based on the review of the LRA and implementing procedures, and a sampling of screening results documentation, 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. LRA Section 2.1.2.1.1, "Identifying Components Subject to Aging Management Review," states:

> Within the system, components are subject to aging management review if they perform an intended function without moving parts or a change in configuration or properties and if they are not subject to replacement based on a qualified life or specified time period.
>
> In making the determination that a component performs an intended function without moving parts or a change in configuration or properties, it is not necessary to consider the piece parts of the component. However, in the case of valves, pumps, and housings for fans and dampers, the valve bodies, pump casings, and housings may perform an intended function by maintaining the pressure boundary and may therefore be subject to aging management review.
>
> Replacement programs are based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life, or replacement frequency under a controlled program. Components that are subject to replacement based on qualified life or specified time period are not subject to aging management review. Where flexible elastomer hoses/expansion joints or other components are periodically replaced, these components are not subject to aging management review.

2.1.5.2.2 Staff Evaluation

The staff reviewed the applicant's methodology used for mechanical component screening as described in LRA Section 2.1.2.1, implementing procedures, design basis documents, and the mechanical scoping and screening results documentation. The staff determined that the applicant used the screening process described in these documents along with the guidance contained in NEI 95-10 and the SRP-LR to identify the mechanical SCs subject to an AMR.

The staff determined that the applicant had identified SCs that were found to meet 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 if the screening methodology outlined in the LRA and implementing procedures was adequately implemented. The staff reviewed portions of the essential cooling water system screening results documentation, had discussions with the applicant, and confirmed proper implementation of the screening process.

2.1.5.2.3 Conclusion

Based on the review of the LRA, implementing procedures, and the sampled mechanical screening results documentation, the staff concludes that the applicant's methodology for identifying 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 an AMR in accordance with the requirements of 10 CFR 54.21. LRA Section 2.1.2.2, "Screening of Structures," states:

> For each structure within the scope of license renewal, the structural components and commodities were evaluated to determine those subject to aging management review. This evaluation (screening process) for structural components and commodities involved a review of site design documents (FSAR, design basis documents, design specifications, site drawings, etc.) to identify specific structural components and commodities that make up the structure. Structural components and commodities subject to aging management review are those that (1) perform an intended function without moving parts or a change in configuration or properties, and (2) are not subject to replacement based on qualified life or specified time period.

2.1.5.3.2 Staff Evaluation

The staff reviewed the applicant's methodology used for structural component screening as described in LRA Section 2.1.2.2, implementing procedures, design basis documents, and the structural scoping and screening results documentation. The staff determined that the applicant used the screening process described in these documents along with the information contained in NEI 95-10 and the SRP-LR, to identify the structural SCs subject to an AMR.

The staff determined that the applicant had identified structural SCs that were found to meet 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 SCs were determined to be subject to an AMR.

The staff performed a sample review to determine if the screening methodology outlined in the LRA and implementing procedures was adequately implemented. The staff reviewed portions of the nuclear plant island structure screening results documentation, had discussions with the applicant, and confirmed proper implementation of the screening process.

2.1.5.3.3 Conclusion

Based on the review of the LRA, implementing procedures, and the sampled structural screening results documentation, 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 an AMR in accordance with the requirements of 10 CFR 54.21. LRA Section 2.1.2.3, "Electrical and Instrumentation and Control Systems," states:

> The electrical and I&C aging management review evaluates commodity groups containing components with similar characteristics. Screening applied to commodity groups determines which electrical and I&C components are subject to aging management review. An aging management review is required for commodity groups that perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties (passive) and that are not subject to replacement based on a qualified life or specified time period (long-lived).

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical component screening as described in LRA Section 2.1.2.3, implementing procedures, design basis documents, and the electrical scoping and screening results documentation. The staff confirmed that the applicant had used the screening process described in these documents along with the guidance contained in NEI 95-10 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 were found to meet the passive criteria in accordance with NEI 95-10. In addition, the staff determined that the applicant evaluated the identified passive commodities to determine those that were not subject to replacement based on a qualified life or specified time period (long-lived). The remaining passive, long-lived components were determined to be subject to an AMR.

The staff performed a sample review to determine if the screening methodology outlined in the LRA and implementing procedures was adequately implemented. The staff reviewed portions of the electrical screening results documentation that identified the in-scope electrical commodities that were determined to be passive and long lived, had discussions with the applicant and confirmed proper implementation of the screening process.

2.1.5.4.3 Conclusion

Based on the review of the LRA, implementing procedures, and the sampled electrical screening results documentation, the staff concludes that the applicant's methodology to identify electrical and I&C 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

Based on the review of the LRA, the screening implementing procedures, 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

Based on its review of LRA Section 2.1, the supporting information in the scoping and screening implementing procedures and documentation, the information presented during the scoping and screening methodology audit, sample system reviews and results documentation, and the applicant's responses dated November 10, 2016, to the staff's RAI dated October 12, 2016, the staff concludes that the applicant's scoping and screening methodology is consistent with the requirements of 10 CFR 54.4 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 systems and structures within the scope of license renewal and SCs requiring an AMR is acceptable.

2.2 Plant Level Scoping Results

2.2.1 Introduction

In LRA Section 2.1, the applicant described the methodology for identifying SSCs within the scope of license renewal. In LRA Section 2.2, "Plant Level Scoping Results," 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 SSCs relied on to mitigate DBEs, as required by 10 CFR 54.4(a)(1); all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2); and all SSCs relied on in safety analyses or plant evaluations to perform functions that demonstrate compliance with the 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, "Mechanical Systems Within the Scope of License Renewal," the applicant listed the WF3 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 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, Table 2.2-2, "Mechanical Systems Not Within the Scope of License Renewal"; Table 2.2-3, "Plant Electrical and I&C Systems Within the Scope of License Renewal"; and Table 2.2-4, "Structures Not Within the Scope of License Renewal," to confirm that there were no omissions of plant level systems and structures within the scope of license renewal.

The staff determined whether the applicant properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The staff reviewed 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." On the basis of its review, the staff did not identify the need for additional information.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2 and the UFSAR supporting information to determine whether the applicant failed to identify any systems and structures within the scope of license renewal. On the basis of its review, the staff concludes that the applicant has appropriately 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 Coolant System"
- LRA Section 2.3.2, "Engineered Safety Features"
- 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 the applicant properly implemented its methodology, the staff's review focused on the implementation results. This focus allowed the staff to verify that the applicant identified the mechanical system SCs that met the scoping criteria and were subject to an AMR, confirming there were no omissions.

The staff's evaluation of mechanical systems was performed using the evaluation methodology described in the guidance in SRP-LR Section 2.3, and it took into account the system function(s) described in the UFSAR. The objective was to determine if the applicant, in accordance with 10 CFR 54.4, has identified components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components are subject to an AMR as required by 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the LRA, applicable sections of the UFSAR, license renewal boundary drawings, and other licensing basis documents, as appropriate, for each mechanical system within the scope of license renewal. The staff reviewed relevant licensing basis documents for each mechanical system to confirm that the LRA specified all intended functions defined by 10 CFR 54.4(a). The review then focused on identifying any components with intended functions defined by 10 CFR 54.4(a) that the applicant may have omitted from the scope of license renewal.

After reviewing the scoping results, the staff evaluated the applicant‘s screening results. For those SCs with intended functions delineated under 10 CFR 54.4(a), the staff verified that the applicant properly screened out only: (1) SCs that have functions performed with moving parts or a change in configuration or properties, or (2) SCs that are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For SCs not meeting either of these criteria, the staff identified the remaining SCs 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 Coolant System

LRA Section 2.3.1 identifies the reactor coolant system (RCS) SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the RCS in the following LRA sections:

- LRA Section 2.3.1.1, “Reactor Vessel”
- LRA Section 2.3.1.2, “Reactor Vessel Internals”
- LRA Section 2.3.1.3, “Reactor Coolant Pressure Boundary”
- LRA Section 2.3.1.4, “Steam Generators”

The staff’s findings on review of LRA Sections 2.3.1.1–2.3.1.4 are provided in SER Sections 2.3.1.1–2.3.1.4, respectively.

2.3.1.1 Reactor Vessel

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 states that the review of the reactor vessel includes the vessel (a component of the RCS) and the control element drive (CED) system. The reactor vessel consists of those components that are designed to enclose and support the reactor vessel internals and the reactor core and to provide a barrier to the release of radioactive materials from the core. The reactor vessel forms part of the RCPB, containing the flow path of reactor coolant through the vessel internals and reactor core. The reactor vessel head provides penetrations for the control element assembly extension and drive shafts, venting, and in-core instrumentation.

The intended function of the reactor vessel is to support the reactor core and control rod drive mechanisms, and to provide a pressure boundary for reactor coolant. The reactor internals support the core, maintain fuel alignment, direct coolant flow, and provide gamma and neutron shielding. Portions of the reactor vessel and internals support fire protection, PTS, and SBO requirements.

LRA Table 2.3.1-1, “Reactor Vessel Components Subject to Aging Management Review,” identifies the component types within the scope of license renewal and subject to an AMR.

The RCS has the following intended functions for 10 CFR 54.4(a)(1):

- Provide sufficient core cooling during normal plant evolutions and anticipated operational occurrences to preclude the occurrence of significant core damage.
- Provide a barrier against the release of fission products from the reactor core to the environment.

- Support containment pressure boundary.

The RCS has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RCS has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (RCP oil collection) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Support the evaluation that demonstrates compliance with the Commission's regulations for pressurized thermal shock (10 CFR 50.61).
- Perform functions (maintain pressure boundary and provide core cooling) that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63).

The CED system controls the position of the control element assemblies as a means of controlling core reactivity and reactor power. The CED system code includes the control element drive mechanism control system components, the control element drive mechanism (CEDM), and the CESs.

The CED system has the following intended function for 10 CFR 54.4(a)(1):

- Support the RCPB.

The CED system has no intended function for 10 CFR 54.4(a)(2) or (a)(3).

LRA Table 2.3.1-1, "Reactor Vessel Components Subject to Aging Management Review," lists the component types that require AMR and their intended function.

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 3.9.4, 4.2.2.4, and 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).

2.3.1.1.3 Conclusion

Based on its evaluation, 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 concludes that the applicant adequately identified the reactor vessel components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

LRA Section 2.3.1.2 states that the reactor vessel internals consists of those components that are designed to distribute the flow of coolant delivered to the vessel, and to align, support, and protect the fuel assemblies. The components of the reactor internals are divided into three major parts consisting of the core support structure assembly, the upper guide structure assembly, and the in-core instrumentation support structure. The flow skirt, although functioning as an integral part of the coolant flow path, is separate from the internals and is welded to the bottom head of the pressure vessel.

The intended function of the reactor vessel is to support the reactor core and control rod drive mechanisms and to provide a pressure boundary for reactor coolant. The reactor internals support the core, maintain fuel alignment, direct coolant flow, and provide gamma and neutron shielding. Portions of the reactor vessel and internals support fire protection, PTS, and SBO requirements.

LRA Table 2.3.1-2, "Reactor Vessel Internals Components Subject to Aging Management Review," identifies the component types within the scope of license renewal and subject to an AMR.

The intended functions of the reactor vessel internals within the scope of license renewal are included in the RCS intended functions in LRA Section 2.3.1, "Reactor Coolant System," and are summarized below.

The RCS has the following intended functions for 10 CFR 54.4(a)(1):

- Provide sufficient core cooling during normal plant evolutions and anticipated operational occurrences to preclude the occurrence of significant core damage.
- Provide a barrier against the release of fission products from the reactor core to the environment.
- Support the containment pressure boundary.

The RCS has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RCS has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (RCP oil collection) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Support the evaluation that demonstrates compliance with the Commission's regulations for pressurized thermal shock (10 CFR 50.61).

- Perform functions (maintain pressure boundary and provide core cooling) that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48) and for SBO (10 CFR 50.63).

Additional details on reactor vessel internals intended functions can be found in FSAR references and UFSAR Section 5.

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 FSAR Section 3.9.5. 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 FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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 evaluation, 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 concludes that the applicant adequately identified the reactor vessel components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Coolant Pressure Boundary

2.3.1.3.1 Summary of Technical Information in the Application

LRA Section 2.3.1.3 states that the reactor coolant pressure boundary (RCPB) is defined in accordance with 10 CFR 50.2 to include all pressure-retaining components such as pressure vessels, piping, pumps, and valves that are part of the RCS, or connected to the RCS, up to and including any and all of the following:

- the outermost containment isolation valve in piping that penetrates primary reactor containment
- the second of the two valves normally closed during normal reactor operation in system piping that does not penetrate primary reactor containment
- The RCS safety valves.

LRA Table 2.3.1-3, "Reactor Coolant Pressure Boundary Components Subject to Aging Management Review," identifies the component types within the scope of license renewal and subject to an AMR.

The RCS has the following intended functions for 10 CFR 54.4(a)(1):

- Provide sufficient core cooling during normal plant evolutions and anticipated operational occurrences to preclude the occurrence of significant core damage.

- Provide a barrier against the release of fission products from the reactor core to the environment.
- Support the containment pressure boundary.

The RCS has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The RCS has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (RCP oil collection) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Support the evaluation that demonstrates compliance with the Commission's regulations for pressurized thermal shock (10 CFR 50.61).
- Perform functions (maintain pressure boundary and provide core cooling) that demonstrate compliance with the Commission's regulations for fire protection (10 CFR 50.48) and for SBO (10 CFR 50.63).

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

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 FSAR Section 5.0. 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 FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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 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).

2.3.1.4 Steam Generators

2.3.1.4.1 Summary of Technical Information in the Application

LRA Section 2.3.1.4 states that the purpose of the steam generator (SG) system is to provide heat removal from the RCS through the generation of steam and also to act as an assured source of steam to the steam-driven auxiliary feedwater (AFW) pump. The system consists of

the primary and secondary pressure boundaries of the SGs, including all pieces and parts within the pressure boundary and all penetrations out to the safe ends of the penetration nozzles.

The intended function of the SG is to provide heat removal from the coolant by the generation of steam for DBE mitigation, SBO, and fire safe shutdown requirements. The SG provides a source of steam to the turbine driven AFW pump. The SG primary channel head and tubes form part of the RCPB. The SG outlet nozzles restrict main steam flow in the event of a main steam line break (MSLB). The SG system supports fire protection, ATWS, and SBO requirements.

The SG system has the following intended functions for 10 CFR 54.4(a)(1):

- Transfer heat from the RCS to the secondary system.
- Limit steam release after a steam line guillotine break to reduce energy release to containment, reduce loads on the SG internals, and limit RCS cooldown following steam line rupture.
- Maintain secondary system pressure boundary.
- Provide a source of steam for the turbine-driven emergency feedwater (EFW) pump.
- Maintain the RCPB.

The SG system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SG system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

LRA Table 2.3.1-4, "Steam Generators Components Subject to Aging Management Review," identifies the component types within the scope of license renewal and subject to an AMR. The reactor coolant inlet and outlet piping and Class 1 instrumentation is reviewed in LRA Section 2.3.1.3, "Reactor Coolant Pressure Boundary." Other SG instrumentation components are reviewed in LRA Section 2.3.4.3, "Main Feedwater." SG blowdown and sampling components are evaluated in Section 2.3.4.4, "Main Steam." Nonsafety-related SG components whose failure could prevent satisfactory accomplishment of safety functions not reviewed in other reports are reviewed in Section 2.3.1.5, "RCS Systems In Scope for 10 CFR 54.4(a)(2). Additional details on SG intended functions can be found in FSAR references and FSAR Section 5.4.2.

2.3.1.4.2 Staff Evaluation

The staff reviewed the system functions described in LRA Section 2.3.1.4, license renewal boundary drawings, and FSAR Sections 5.4.2, 5.4.4, and 10.3 to determine if the applicant failed to identify any SSCs within the scope of license renewal. In addition, the staff's review

determined if the applicant failed to identify any components subject to an AMR. 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 SG system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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).

2.3.1.4.3 Conclusion

Based on its evaluation, the staff concludes that the applicant appropriately identified the SG 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 SG components subject to an AMR, as required by 10 CFR 54.21(a)(1).

The staff reviewed the LRA and FSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff'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 SGs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

LRA Section 2.3.2 identifies the engineered safety features (ESF) SCs subject to an AMR for license renewal. The applicant described the ESF supporting SCs in the following LRA sections:

- LRA Section 2.3.2.1, "Containment Spray"
- LRA Section 2.3.2.2, "Safety Injection"
- LRA Section 2.3.2.3, "Containment Penetrations"
- LRA Section 2.3.2.4, "ESF Systems in Scope for 10 CFR 54.4(a)(2)"

The staff's findings on review of LRA Sections 2.3.2.1–2.3.2.4 are in SER Sections 2.3.2.1–2.3.2.4, respectively.

2.3.2.1 Containment Spray

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 states that the purpose of the containment spray (CS) system is to remove heat from containment following an accident inside containment. In conjunction with the containment cooling heating, ventilation, and air conditioning (HVAC) system, the CS system maintains the containment pressure and temperature within design limits and limits offsite radiation levels by reducing the driving force for fission product leakage from the containment atmosphere to the external environment. The CS system also limits offsite radiation doses by the reduction of iodine in the post-accident containment atmosphere.

The LRA states that the CS system has the following intended functions for 10 CFR 54.4(a)(1):

- Remove heat to maintain the containment pressure and temperature within design limits and limit offsite radiation levels by reducing the driving force for fission product leakage from the containment atmosphere to the external environment.
- Remove iodine from the containment atmosphere and retain it in solution to limit dose consequences.
- Support containment pressure boundary.

The CS system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CS system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (shutdown cooling heat exchanger) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

LRA Table 2.3.2-1, "Containment Spray System Components Subject to Aging Management Review," identifies the component types within the scope of license renewal and subject to an AMR. The Trisodium phosphate dodecahydrate (TSP) baskets are evaluated as structural components in Section 2.4.1, "Reactor Building." The refueling water storage pool is a structural component and is reviewed in Section 2.4.2, "Nuclear Plant Island Structure." Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.4, "ESF Systems in Scope for 10 CFR 54.4(a)(2)."

Additional details on CS intended functions can be found in FSAR references and FSAR Sections 6.2.2 and 6.5.2.

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1, FSAR Sections 6.2.2 and 6.5.2, and LRA Table 2.3.2-1 using the evaluation methodology as described in guidance in SRP-LR Section 2.3 and SER Section 2.3.

The staff evaluated the CS system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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 CS 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 CS components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.2 Safety Injection

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 states that the purpose of the safety injection (SI) system is to provide core cooling following a design basis accident. The system is designed to inject borated water into the RCS to flood and cool the reactor core and to provide heat removal from the core for extended periods following a loss-of-coolant accident (LOCA). The system is also designed to inject borated water into the RCS to increase the shutdown margin following a rapid cooldown due to a main steam line break (MSLB). In addition to its accident-related functions, portions of the SI system are used as part of the shutdown cooling system, which removes heat from the RCS during normal plant cooldown and refueling.

The LRA states that the SI system has the following intended functions for 10 CFR 54.4(a)(1):

- Inject borated water into the RCS to flood and cool the reactor core and to provide heat removal from the core for extended periods following a LOCA.
- Inject borated water into the RCS to increase the shutdown margin following a rapid cooldown due to an MSLB.
- Provide shutdown cooling flow through the reactor core and shutdown cooling heat exchanger for normal plant shutdown cooling operation.
- Maintain integrity of RCPB.
- Support containment pressure boundary.

The LRA also states that the SI system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

In addition, the SI system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (shutdown cooling mode) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

LRA Table 2.3.2-2, “Safety Injection System Components Subject to Aging Management Review,” identifies the component types within the scope of license renewal and subject to an AMR.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2, FSAR Sections 6.3 and 9.3.6 (shutdown cooling), and LRA Table 2.3.2-2 using the evaluation methodology as described in guidance in SRP-LR Section 2.3 and SER Section 2.3.

The staff evaluated the SI system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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 SI 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 SI components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.3 Containment Penetrations

2.3.2.3.1 Summary of Technical Information in the Application

LRA Section 2.3.2.3 states that the primary containment is a freestanding steel pressure vessel that is surrounded by a reinforced-concrete Shield Building. The containment vessel is a cylindrical steel pressure vessel with hemispherical dome and ellipsoidal bottom that houses the reactor pressure vessel, the reactor coolant piping, the pressurizer, the quench tank, the RCPs, SGs, and safety injection tanks. It is completely enclosed by the reinforced concrete Shield Building. An annular space is provided between the walls and domes of the containment vessel and the concrete Shield Building to permit construction operations and inservice inspection.

The containment vessel and Shield Building contain mechanical penetrations that provide openings for process fluids to pass through the containment boundaries and still maintain containment integrity. The mechanical penetrations, their associated isolation valves, and related design features that are not included in another AMR are included in this review. The grouping of containment isolation valves from various plant systems into a consolidated review is appropriate for scoping as indicated in NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” Section 2.1.3.1.

Systems described or referenced below have the following intended function for 10 CFR 54.4(a)(1).

- Support containment pressure boundary.

With the exception of the containment vacuum relief (CVR) system, the systems described below have no other system intended functions. Systems described elsewhere in the application have additional intended functions included in other AMRs as referenced.

<u>Containment Vacuum Relief</u>. The purpose of the CVR system is to prevent excess external pressure on the primary containment steel shell. The system consists of two redundant penetrations that connect the Shield Building annulus with the containment atmosphere. The penetrations provide a flow path for air to pass from the annulus to the containment. Each flow path is provided with its own set of isolation valves, which remain closed during normal operation.

In the event that the air pressure inside containment drops below that of the annulus, system instrumentation opens the automatic isolation valves, which allow air pressure in the annulus to bleed into the containment.

Pneumatic operated butterfly valves are installed on the annulus side of the containment penetrations. These valves serve as both automatic relief valves and containment isolation valves. The valves are provided with backup air accumulators that will allow valve operation in the event of a loss of instrument air. Check valves are installed on the containment side of the penetrations and serve as containment isolation valves. The valves have magnetic latches that hold the valve in the closed position, but the valves will open quickly against a small differential pressure.

In addition to the intended function of supporting containment pressure boundary, the CVR system has the following intended function for 10 CFR 54.4(a)(1):

- Protect the containment vessel from external pressure by limiting the pressure differential between the Shield Building annulus and containment atmosphere.

Fuel Handling and Storage. The purpose of the fuel handling and storage (FHS) system is to provide the ability to defuel and refuel the reactor core. The FHS system provides a safe, effective means of transporting, handling, and storing fuel and control element assemblies. The majority of the components in the FHS system code are structural components and are covered in the structural AMRs.

The fuel transfer tube and blind flange are considered part of this system code. These components form part of the containment pressure boundary.

Hydrogen Recombiners and Analyzers. The purpose of the hydrogen recombiners and analyzers (HRA) system is to monitor the hydrogen gas concentration in the containment and to limit that concentration by recombination with oxygen. The stationary thermal recombiners each consist of an inlet pre-heater section, a heater-recombination section, and a louvered exhaust chamber. They are designed and operated on the principle of natural convection, requiring no moving parts.

The system includes two hydrogen analyzers. Each consists of sample and return lines, isolation valves, and a hydrogen analyzer that includes sample coolers, moisture separators, and sample pumps. For each unit, there are seven sample lines that take six separate samples of the containment atmosphere and one sample of the annulus atmosphere. Each set of six lines has a common header inside the containment and penetrates the containment in a separate penetration assembly.

The hydrogen recombiners and analyzer components are classified as safety-related. However, consistent with changes to 10 CFR 50.44, Amendment 192 to the WF3 operating license eliminated the requirement for these components to mitigate the consequences of a design basis accident. Consequently, apart from support of the containment pressure boundary, the HRA system has no safety function.

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.3, FSAR Sections 3.8.2.3 and 6.2.1.1.2 (CVR), 9.1.4 (FHS), 6.2.5.2.1 and 6.2.5.2.2 (HRA), and LRA Table 2.3.2-3 using the evaluation methodology as described in guidance in SRP-LR Section 2.3 and SER Section 2.3.

The staff evaluated the containment penetrations system functions described in the LRA and FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as 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 containment penetrations 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 containment penetrations components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.4 ESF Systems in Scope for 10 CFR 54.4(a)(2)

2.3.2.4.1 Summary of Technical Information in the Application

LRA Section 2.3.2.4 states that the systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) interact with safety-related systems in one of two ways: functional or physical. A functional failure is one in which the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one in which a safety function is impacted by the loss of structural or mechanical integrity of an SSC.

Systems that could give rise to interactions resulting from physical impact or flooding and systems that contain nonsafety-related high-energy lines that can affect safety-related equipment are considered within the scope of license renewed based on the criterion of 10 CFR 54.4(a)(2).

The following ESF systems, described in the referenced LRA sections, are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interactions:

- containment spray (LRA Section 2.3.2.1)
- safety injection (LRA Section 2.3.2.2)

LRA Tables 2.3.2-4-1 and 2.3.2-4-2 identify the miscellaneous ESF systems in scope for 10 CFR 54.4(a)(2) component types that are within the scope of license renewal and subject to an AMR.

2.3.2.4.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.1 and 2.3.2.2; UFSAR Sections 6.2.2, 6.3, 6.5.2, and 9.3.6; and LRA Tables 2.3.2-4-1 and 2.3.2-4-2 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 the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.2.4.3 Conclusion

Based on the results of the staff's evaluation, the staff concludes that the applicant appropriately identified the ESF systems in scope for 10 CFR 54.4(a)(2) 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 ESF systems in scope for 10 CFR 54.4(a)(2) components subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

LRA Section 2.3.3 identifies the auxiliary systems SCs 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, "Chemical and Volume Control"
- LRA Section 2.3.3.2, "Chilled Water"
- LRA Section 2.3.3.3, "Component Cooling and Auxiliary Component Cooling Water"
- LRA Section 2.3.3.4, "Compressed Air"
- LRA Section 2.3.3.5, "Containment Cooling HVAC"
- LRA Section 2.3.3.6, "Control Room HVAC"
- LRA Section 2.3.3.7, "Emergency Diesel Generator"
- LRA Section 2.3.3.8, "Fire Protection: Water"
- LRA Section 2.3.3.9, "Reactor Coolant Pump Oil Collection"
- LRA Section 2.3.3.10, "Fuel Pool Cooling and Purification"
- LRA Section 2.3.3.11, "Nitrogen"
- LRA Section 2.3.3.12, "Miscellaneous HVAC"
- LRA Section 2.3.3.13, "Auxiliary Diesel Generator"
- LRA Section 2.3.3.14, "Plant Drains"
- LRA Section 2.3.3.15, "Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)"

The staff's findings on review of LRA Sections 2.3.3.1–2.3.3.15 are in SER Sections 2.3.3.1–2.3.3.15, respectively.

2.3.3.1 Chemical and Volume Control

2.3.3.1.1 Summary of Technical Information in the Application

The purpose of the chemical and volume control (CVC) system is to control the RCS inventory, purity, and chemistry. Chemicals or additional coolant (e.g., primary water and boric acid) can be added to the volume control tank to adjust RCS chemistry or to increase inventory. The charging pumps take suction from the volume control tank and pump the coolant back into the RCS. Discharge from the charging pumps is normally returned through the regenerative heat

exchanger to the RCS flow stream between the reactor coolant pumps and the reactor vessel. The CVC system also collects controlled bleed-off from the reactor coolant pump seals.

The CVC system has the following intended functions for 10 CFR 54.4(a)(1):

- Maintain the RCS inventory.
- Control boron concentration in the RCS.
- Provide auxiliary pressurizer spray.
- Inject concentrated boric acid into the RCS upon a safety injection actuation signal.
- Maintain integrity of RCPB.
- Support containment pressure boundary.

The CVC system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CVC system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (letdown isolation) that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

Boric Acid Makeup. The purpose of the boric acid makeup (BAM) system is to provide a source of concentrated boric acid for RCS reactivity control and shutdown margin requirements. As part of the CVC system, the BAM system can supply boric acid to the RCS through the volume control tank and charging pumps for normal makeup, or directly through the charging pumps if necessary for load changes or shutdown margin control following an accident.

The BAM system has the following intended function for 10 CFR 54.4(a)(1):

- Provide a source of concentrated boric acid to the CVC system for RCS reactivity control and shutdown margin requirements.

The BAM system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The BAM system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1, UFSAR Sections 9.3.4 and 9.3.4.2.1.2, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 CVC and BAM 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 stated in 10 CFR 54.21(a)(1).

2.3.3.2 Chilled Water

2.3.3.2.1 Summary of Technical Information in the Application

The purpose of the chilled water system is to provide chilled water for air handling systems in various parts of the Reactor Auxiliary Building (RAB).

Essential Chilled Water System. The purpose of the essential chilled water system is to provide chilled water for those air handling systems that cool spaces containing equipment required for safety-related operations. The essential chilled water system furnishes chilled water for space cooling purposes and rejects heat through the component cooling water system (CCWS).

The system consists of three full-capacity water chiller subsystems, each consisting of one chiller, pump, and expansion tank with level control actuated makeup, and instrumentation and controls, piping, and valves. The chiller's cool water is pumped to the cooling coils of the air handling units in various parts of the Reactor Auxiliary Building.

Supplementary Chilled Water System. The purpose of the supplementary chilled water system is to provide chilled water to non-safety related air handling units located in the Reactor Auxiliary Building. The supplementary chilled water system consists of a chilled water recirculation loop with two packaged chiller units operating in series in a “lead/lag” configuration. The chilled water recirculation loop consists of two half-capacity chiller units, two full-capacity pumps, eight air handling unit cooling coils, expansion tank, chemical addition pot, piping, valves, and instrumentation and controls.

The essential chilled water system has the following intended function for 10 CFR 54.4(a)(1):

- Provide chilled water for those air handling systems that cool spaces containing equipment required for safety-related operations.

The essential and supplementary chilled water systems have the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The essential chilled water system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2, UFSAR Section 9.2.9, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.2.3 Conclusion

Based on the results of the staff 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 chilled water 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 stated in 10 CFR 54.21(a)(1).

2.3.3.3 Component Cooling and Auxiliary Component Cooling Water

2.3.3.3.1 Summary of Technical Information in the Application

Component Cooling Water. LRA Section 2.3.3.3 states that the purpose of the component cooling water system (CCWS) is to remove heat from the reactor coolant and the auxiliary systems during normal operation, shutdown, or emergency shutdown following a LOCA or an MSLB inside containment. The CCWS includes two CCWS heat exchangers, three full-capacity pumps, two DCTs, one surge tank (baffled), one chemical addition tank, piping, valves, and instrumentation and controls. There are two redundant, independent, full-capacity CCWS system trains. CCWS cooling water is pumped through the DCTs and the tube side of the component cooling heat exchangers, through the components being cooled, and back to the pumps.

The CCWS has the following intended functions for 10 CFR 54.4(a)(1):

- Dissipate the heat removed from the reactor and its auxiliaries during normal unit operation, during refueling, or after a design basis accident.
- Support containment pressure boundary.

The CCWS has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CCWS has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Auxiliary Component Cooling Water. The CCWS and auxiliary component cooling water (ACC) systems work together to supply sufficient cooling to safety and nonsafety-related reactor auxiliaries under all modes of operation. The purpose of the ACC system is to remove heat from the CCWS, if required, during normal operation, shutdown, or emergency shutdown following a LOCA or an MSLB inside containment. There are two redundant, independent, full-capacity ACC trains, one for each train of the CCWS. Each train of the ACC system includes a CCWS heat exchanger (shell side), a full-capacity pump, and a wet type, mechanical draft cooling tower and cooling tower basin.

The ACC system is required to operate whenever the heat rejection capacity of the CCWS is exceeded by accident conditions, or whenever the outside ambient conditions prevent the CCWS from rejecting its required heat load by way of the DCTs. The ultimate heat sink consists of the CCWS DCTs and the ACC system wet cooling towers with water stored in the wet cooling tower basins.

Replenishment of the wet cooling tower basins from onsite water sources and/or the Mississippi River may be required in response to a tornado event if the tornado ejects water from the cooling tower basins. Additional makeup can also be provided directly to the wet cooling tower basins using the portable pump and a fire hose from the potable water supply through a fire hydrant. In the event these sources are not available, provisions are in place to use the portable, diesel-driven pump to supply water from the Mississippi River to the circulating water system, which has piping that can be used to gravity feed makeup to the basin. The function of providing makeup water to the wet cooling tower basin is an intended function of the circulating water system.

The ACC system has the following intended functions for 10 CFR 54.4(a)(1):

- In conjunction with the component cooling system, the ACC system dissipates the heat removed from the reactor and its auxiliaries during normal unit operation, during refueling, or after a design basis accident.
- Provide a source of water to the suction of the EFW pumps if the condensate storage pool is depleted.

The ACC system has no intended function for 10 CFR 54.4(a)(2).

The ACC system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Circulating Water. The circulating water (CW) system provides cooling water to the main condenser to condense steam exhausted from the main turbine, the feedwater turbines, and other condensate drain sources. The CW system also provides cooling to the RCS by cooling steam dumped to the condenser through the bypass valves during plant startup and shutdown. The CW system also provides cooling to the turbine closed cooling water system heat exchangers and the SG blowdown heat exchangers.

The CW system is credited to provide emergency makeup to wet cooling towers A and B following a tornado. A portable diesel-driven pump provides water from the Mississippi River to the CW system, which can then gravity feed makeup to the basin through underground piping.

The CW system has no intended functions for 10 CFR 54.4(a)(1).

The CW system has the following intended functions for 10 CFR 54.4(a)(2):

- Provide a source of makeup to the wet cooling tower basins following a tornado.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CW system has no intended functions for 10 CFR 54.4(a)(3).

Control Element Drive Mechanism Cooling. The control element drive mechanism cooling (CDC) system cools the magnetic jack coils of the CEDM during normal operation. The CDC system consists of four exhaust fans, four inlet dampers, water cooling coils, and associated ductwork. Two of the four fans operate to maintain a negative pressure inside the cooling shroud for the magnetic jack coil elements. The other two fans serve as standby units. The nonsafety-related cooling coils provide a pressure boundary function for the CCWS.

The CDC system has no intended functions for 10 CFR 54.4(a)(1) and (a)(3).

The CDC system has the following intended function for 10 CFR 54.4(a)(2):

- Support the CCWS pressure boundary.

LRA Table 2.3.3-3 identifies the CCWS and ACC system 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 Sections 9.2.2, 9.2.5, 9.4.5.7 and 10.4.5, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with

intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 component cooling and auxiliary component cooling 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 stated in 10 CFR 54.21(a)(1).

2.3.3.4 Compressed Air

2.3.3.4.1 Summary of Technical Information in the Application

LRA 2.3.3.4 states that the purpose of the compressed air system (CAS) is to provide a reliable supply of dry, oil-free air for pneumatic instruments and controls, pneumatically operated valves and the necessary service air for normal plant operation and maintenance.

The CAS consists of two instrument air compressors, one instrument air receiver, two instrument air dryers with pre- and after-filters, three station air compressors, one station air receiver, piping, valves, and instrumentation. Most components of the system serve no safety function because they are not required to achieve safe shutdown or to mitigate the consequences of an accident. Air or nitrogen accumulators are provided as backup to the normal instrument air for valves required for operation during the safe shutdown of the plant following an accident or to mitigate the consequences of an accident.

The CAS has the following intended functions for 10 CFR 54.4(a)(1):

- Provide a reserve supply of compressed air (via accumulators, backup air bottles, and related components) to support safety functions of air-operated valves for safe shutdown and accident mitigation.
- Support containment pressure boundary.

The CAS has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CAS has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (nitrogen pressure boundary) that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
- Perform a function (nitrogen pressure boundary) that demonstrates compliance with the Commission’s regulations for SBO (10 CFR 50.63).

Emergency Breathing Air. The purpose of the emergency breathing air (EBA) system is to provide high-quality breathing air for people in the control room envelope to ensure control room habitability during a fire and certain toxic gas events. The system includes an air compressor, purifier filters, four high-pressure air storage tanks, pressure regulators, and piping and valves for distribution to seven manifolds around the control room envelope.

The EBA system has no intended functions for 10 CFR 54.4(a)(1).

The EBA system has the following intended function for 10 CFR 54.4(a)(2):

- Provide stored, compressed air to the control room during a toxic gas release.

The EBA system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Containment Building. The purpose of the CB system mechanical components is to support the containment pressure boundary. The mechanical components include accumulators, filters, piping, and valves that support the operation and testing of seals for the maintenance hatch, containment personnel lock, and containment escape lock.

The CB system has the following intended function for 10 CFR 54.4(a)(1):

- Support containment pressure boundary.

The CB system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CB system has no intended functions for 10 CFR 54.4(a)(3).

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4, UFSAR Sections 6.3.3.5, 6.4.4.2.f, 6.5.3.1, 9.3.1, 9.3.9.2.1, and 9.5.1.3.1, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.4.3 Conclusion

Based on the results of the staff 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 stated in 10 CFR 54.21(a)(1).

2.3.3.5 Containment Cooling HVAC

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 states the purpose of the containment cooling HVAC system (CCS) is to remove heat from the containment atmosphere and, therefore, maintains the containment pressure and temperature at acceptably low levels. During normal plant operations, the CCS operates continuously to maintain the pressure, temperature, and humidity. Following an accident, the CCS, in conjunction with the CS system, removes heat to maintain the containment pressure and temperature within design limits and limits offsite radiation levels by reducing the driving force for fission product leakage from the containment atmosphere to the external environment.

LRA Table 2.3.3-5 identifies the components subject to an AMR for the containment cooling HVAC system by component type and intended function.

The CCS has the following intended function for 10 CFR 54.4(a)(1):

- Maintain the containment pressure and temperature within design limits and limit offsite radiation levels by reducing the driving force for fission product leakage from the containment atmosphere to the external environment.

The CCS has no intended function for 10 CFR 54.4(a)(2).

The CCS has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5, UFSAR Section 6.2.2, 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 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.5.3 Conclusion

Based on the results of the staff 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 containment cooling HVAC 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 stated in 10 CFR 54.21(a)(1).

2.3.3.6 Control Room HVAC

2.3.3.6.1 Summary of Technical Information in the Application

LRA Section 2.3.3.6 states the purpose of the control room heating, ventilation, and air conditioning (HVC) system is to maintain habitable conditions in the control room, computer room, computer room supplementary air conditioning equipment room, HVC equipment room, emergency living quarters, emergency storage room, toilets, locker rooms, kitchen, kitchenette, supervisor's office, corridors, conference room, and vault. Control room habitability systems are required to assure that the operators can remain in the control room to operate the plant safely under normal conditions and maintain the unit in a safe condition under accident conditions.

LRA Table 2.3.3-6 identifies the components subject to an AMR for the control room HVAC system by component type and intended function.

The HVC system has the following intended functions for 10 CFR 54.4(a)(1):

- Remove heat from the control room following an accident.
- Provide filtered outside air following an accident to maintain a positive pressure in the control room and to maintain the control room air quality within limits following an accident.

The HVC system has no intended functions for 10 CFR 54.4(a)(2).

The HVC system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6, UFSAR Sections 6.4 and 9.4.1 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 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance

with 10 CFR 54.21(a)(1). 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 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 control room HVAC 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 stated in 10 CFR 54.21(a)(1).

2.3.3.7 Emergency Diesel Generator

2.3.3.7.1 Summary of Technical Information in the Application

The purpose of the emergency diesel generator (EDG) system is to provide an emergency source of AC power to safety buses during a loss of the preferred (offsite) and standby (onsite) AC power supplies to permit the ESF systems to perform their safety functions. The system includes two independent diesel generators, each with independent support systems.

The EDG air system includes starting air, control and shutdown air, and the combustion air intake and exhaust. Each diesel has two identical, redundant, skid-mounted air start systems, each consisting of an air compressor, an air receiver with two air accumulation pipes (which provide air storage capacity), an air dryer, filters, and associated valves, piping, and instrumentation.

The EDG cooling system consists of an engine-driven main jacket water pump, motor-driven circulating jacket water pump, water cooler cooled by component cooling water, standby jacket water heater, standpipe (surge tank), and associated piping, valves, and instrumentation.

The EDG fuel system consists of a crankshaft-driven primary fuel oil booster pump, direct-current (DC) motor-driven standby fuel oil booster pump, fuel oil cooler, fuel oil feed tank, filters, strainers, fuel oil storage tank, fuel oil transfer pump, fuel injection pumps, and associated piping, valves, and instrumentation.

The EDG lube oil system consists of an engine-driven main lube oil pump, motor-driven standby lube oil pump, motor-driven pre-lube pump, oil coolers cooled by the component cooling water system, strainers, filters, standby lube oil heater, crankcase oil sump, maintenance lube oil storage tank, and associated piping, valves, and instrumentation.

The EDG system has the following intended function for 10 CFR 54.4(a)(1):

- Provide an emergency source of AC power to safety buses during a loss of the preferred (offsite) and standby (onsite) AC power supplies to permit the ESF systems to perform their safety functions.

The EDG system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The EDG system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (portable air compressor) that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

LRA Table 2.3.3-7 identifies the EDG 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 8.3.1.1.1, 9.5.4 through 9.5.8, as well as 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 UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 EDG 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 stated in 10 CFR 54.21(a)(1).

2.3.3.8 Fire Protection: Water

2.3.3.8.1 Summary of Technical Information in the Application

LRA Section 2.3.3.8 states that the purpose of the fire protection (FP) system is to ensure the capability to safely shutdown the reactor, maintain it in a safe-shutdown condition, continue to control radioactive releases to the environment, and prevent personnel injury and property damage in the event of a fire. The FP system includes components in system codes FP (fire protection system) and outside fire protection (OFP).

FP within the protected area is provided by components in the FP system code. The FP system stores water for the control and suppression of anticipated fires and distributes the water

through a network of underground mains and distribution piping to the sprinklers and hose stations. The FP system consists of two storage tanks, three fire pumps, a jockey pump, and the associated piping and valves to supply water to sprinklers, standpipes, and hydrants. The diesel fuel oil (DFO) tanks and other diesel support equipment are included in the DFO system code. The purpose of the DFO system is to provide a supply of fuel oil for the operation of the two diesel-driven fire pumps and the auxiliary diesel generator (ADG) (also referred to as the security diesel generator). The system includes tanks, piping, valves, instruments, and controls to support operation of the diesels. The ADG supports lighting requirements for a station blackout. The DFO system does not support operation of the EDGs or the auxiliary boiler, which have separate fuel oil systems.

The treated water system provides a water source for the fire water storage tank, demineralized water system, and sealing and cooling water for various pumps. The treated water system includes components from the system codes TW (treated water system) and BO (BOZE system, the primary water treatment package). The treated water system is no longer used for processing raw water from the Mississippi River. The treated water system has been inactivated except for the clear well tank, clear well transfer pumps, bearing lubrication water pumps for the circulating water pumps, and associated piping, valves, instrumentation, and controls.

The three fire pumps, one motor-driven and two diesel-driven, can take suction from either or both of the storage tanks. The jockey pump maintains fire main pressure. The firewater pumps discharge into the distribution system.

The water distribution system consists of underground yard piping serving all plant yard fire hydrants, sprinkler systems, water spray systems, and interior standpipe systems. The underground piping forms a complete fire loop around the plant. The main fire loop supplies two other fire loops: the Reactor Auxiliary Building, which in turn supplies the CB, and the Turbine Building.

The FP system also includes a separate fire suppression system, with a storage tank, pumps, piping, valves, sprinklers, hydrants, and hose houses. This separate system, which includes components of system codes OFP and FP, provides fire protection for selected buildings outside the protected area.

The FP system includes fire dampers that are either installed in ductwork or mounted in walls. Fire dampers mounted in walls are included in the evaluation of structural commodities.

Where necessary to support a license renewal intended function, fire dampers installed in ductwork are included in the evaluation of the related HVAC system. WF3 does not use a halon fire suppression system or a carbon dioxide suppression system.

The fire protection water system has the following intended function for 10 CFR 54.4(a)(1):

- Maintain containment pressure boundary.

The fire protection water system has the following intended function for 10 CFR 54.4(a)(3):

- Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for FP (10 CFR 50.48). The FP System provides the capability to control postulated fires in plant areas to maintain safe shutdown ability.

LRA Table 2.3.3-8 identifies the FP system component types that are 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 and the relevant LRA drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff also reviewed FSAR Section 9.5.1, "Fire Protection System," which describe the FP program at WF3, and how it complies with the requirements of 10 CFR Section 50.48, "Fire protection," and the guidelines of Appendix A to Branch Technical Position (BTP), "Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1."

The staff also reviewed the following FP documents cited in the CLB listed in WF3, Operating License Condition 2.C(9):

- NUREG-0787, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," July 1981.
- NUREG-0787, Supplement 1, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," October 1981.
- NUREG-0787, Supplement 3, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," April 1982.
- NUREG-0787, Supplement 5, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," June 1982.
- NUREG-0787, Supplement 6, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," June 1984.
- NUREG-0787, Supplement 8 "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," December 1984.
- NUREG-0787, Supplement 10, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," March 1985.

During its review, the staff evaluated the system functions described in the LRA and FSAR Section 9.5.1 to verify that the applicant had not omitted from the scope of license renewal any components with intended functions in accordance with 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 2.3.3.8, 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 requests for additional information (RAIs) as discussed below.

In RAI 2.3.3.8-1, by letter dated November 15, 2016, the staff noted that "…Waterford 3 is in the process of transitioning to the National Fire Protection Association (NFPA) 805 risk-informed, performance-based fire protection program. However, this process has not been completed; this license renewal application is based on the site's requirements under 10 CFR 50.48 and Appendix R…" On June 27, 2016, the NRC issued a license amendment for WF3 to incorporate NFPA 805 fire protection licensing basis in accordance with 10 CFR 50.48(c). The

amendment authorizes the transition of the licensee's FP program to a risk-informed, performance-based program based on the 2001 Edition of NFPA 805.

The FP program scoping and screening information in the March 23, 2016, WF3 LRA was based on 10 CFR 50.48(b) and Appendix R compliance. Subsequently, on June 27, 2016, the NRC issued the NFPA 805 FP license amendment in accordance with 10 CFR 50.48(c). Because the NFPA 805 license condition supersedes the WF3 FP license condition in place at the time the applicant submitted the WF3 LRA, the staff determined that the NFPA 805 transition process will impact the scoping and screening of the FP systems and components.

The staff requested that the applicant provide a supplement to the LRA consistent with the new NFPA 805 licensing basis. The supplement should include a revision that demonstrates that the LRA scoping and screening Section 2.3.3.8, "Fire Protection: Water," Section 2.3.3.9, "Reactor Coolant Pump Oil Collection," and Section 2.4, "Scoping and Screening Results: Structures," (only fire barrier portion) remain consistent with the 10 CFR 50.48(c) and NFPA 805 licensing basis.

In response to RAI 2.3.3.8-1, by letter dated January 16, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17016A027), the applicant provided revised LRA scoping and screening of FP sections. The revision included a demonstration that the LRA was consistent with the 10 CFR 50.48(c) and NFPA 805 licensing basis. The applicant also provided conforming changes related to the FP program in accordance with 10 CFR 50.48(c) and NFPA 805. The applicant responded to RAI 2.3.3.8-1 by stating that the WF3 scoping and screening have been compared to the site documentation for the NFPA 805 transition, including the evaluation of nonpower operations. LRA Section 2.3.3.8, "Fire Protection: Water," is revised to better describe the purpose of the FP water system in the FP program. The NFPA 805 transition did not change system intended functions for the FP water system, nor were there additions or deletions of component types subject to an AMR. The description of the FP water system in FSAR Section 9.5.1 has not changed, with the exception of the addition of references to 10 CFR 50.48(c) and the fire safety analysis calculations.

LRA Section 2.3.3.9, "Reactor Coolant Pump Oil Collection," requires no change for the NFPA 805 transition. The system continues to perform a function, as described in the LRA, which demonstrates compliance with the Commission's regulations for FP (10 CFR 50.48).

LRA Section 2.4, "Scoping and Screening Results: Structures," is revised to delete a reference to Appendix R. There are no changes to fire barrier component types subject to an AMR.

Based on the applicant's January 16, 2017, supplemental submittal and supporting information supplied in response to the RAI, the staff finds that the applicant adequately addressed the staff's concerns. The applicant identified changes in accordance with 10 CFR 50.48(c) and NFPA 805 FP program for the license renewal. The applicant adequately addressed the staff's concern related to the NFPA 805 licensing basis; therefore, the staff's concern described in RAI 2.3.3.8-1 is resolved.

In RAI 2.3.3.8-2, by letter dated November 15, 2016, the staff noted that the following boundary drawings show FP systems/components as not within the scope of license renewal (i.e., not colored in red):

LRA Drawing	Systems/Components	Location
LRA-G161, sheet 1	Fire hydrants 8A and 8B	B1, C1

LRA-G164, sheet 3	Fuel oil tank Nos. 1 and 2 components	G2 to G6

The staff requested that the applicant verify whether the FP systems/components listed above are within the scope of license renewal in accordance with 10 CFR 54.4(a) and whether they are subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are not within the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In response to RAI 2.3.3.8-2, by letter dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that fire hydrants 8A and 8B protect the outside of the Maintenance Support Building. The Maintenance Support Building houses no equipment required for safe shutdown. These hydrants are not required for compliance with 10 CFR 50.48 and, therefore, have no license renewal intended function. Further, the applicant stated that the fuel oil tanks', Nos. 1 and 2, components are subject to an AMR with the exception of the level indicators entering through the top of the tanks as depicted on the drawing. Failure of the level indicators cannot affect the pressure boundary of the tanks and they perform no other license renewal intended functions.

Based on its review, the staff finds the applicant's response to the first portion of RAI 2.3.3.8-2 acceptable. The staff finds the hydrants in question are not credited to meet the requirements for achieving safe-shutdown in the event of a fire and were correctly excluded from the scope of license renewal and not subject to an AMR. Should an age-related pressure boundary failure occur in the not-in-scope portion of the system such that a significant system pressure drop results, an alarm would notify plant personnel and the fire water pump(s) would start automatically. Following the alarm and pump start, plant personnel would investigate the cause and manually close the isolation valve(s) separating the failed not-in-scope portion of the system from the in-scope portion, as warranted, considering the need to preserve fire water inventory for 10 CFR 50.48 compliance.

With respect to the second portion of RAI 2.3.3.8-2, the applicant included fuel oil tanks', No. 1 and 2, components subject to an AMR with the exception of the level indicators entering through the top of the tanks. The applicant excluded the portion of the fuel oil tanks' level indicators from an AMR under 10 CFR 54.21 (a)(1)(ii) on a plant-specific basis. Because the applicant has interpreted the portion of the fuel oil tanks' level indicators as part of an active component (condition monitoring to determine whether the level indicators are at the end of their qualified lives), the staff concludes that the component was correctly excluded from the scope of license renewal and is not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.8-2 is resolved.

In RAI 2.3.3.8-3, by letter dated November 15, 2016, the staff stated that LRA Tables 2.3.3-8 and 3.3.2-8 do not include the following FP components:

- fire water nozzles
- standpipe risers
- fire suppression system filter housings
- floor drains for fire water

The staff requested that the applicant verify whether the FP 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 response to RAI 2.3.3.8-3, by letter dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that: fire water nozzles are identified as sprinklers, which are subject to an AMR as shown in LRA Tables 2.3.3-8 and 3.3.2-8. Standpipe risers are vertical runs of piping. Piping is subject to an AMR as shown in LRA Tables 2.3.3-8 and 3.3.2-8. There are no fire suppression system filter housings. However, strainer housings are subject to an AMR as shown in LRA Tables 2.3.3-8 and 3.3.2-8. Floor drains are evaluated as part of the plant drains system described in LRA Section 2.3.3.14. As indicated in that section, water discharged from fire suppression systems is handled by the floor drain systems, but this function is not credited for an internal flooding event.

Based on its review, the staff finds that the applicant's response to RAI 2.3.3.8-3 is acceptable. The applicant has included the following items in the scope of license renewal and subject to an AMR because of their intended functions as part of the pressure boundary: (1) nozzles are included in the sprinklers commodity, and (2) standpipe risers are included in the piping commodity. The strainers housings are subject to an AMR, and there are no filter housings associated with the fire suppression systems at WF3. The applicant indicated that the floor drains for fire water are being included in plant drain systems in LRA Section 2.3.3.14, for processing fire-fighting water. Therefore, the staff's concern described in RAI 2.3.3.8-3 is resolved.

2.3.3.8.3 Conclusion

Based on the results of the staff evaluation discussed in SER Section 2.3 and on a review of the LRA, FSAR, Section 9.5.1, "Fire Protection System," and Section 9A, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the FP SSCs 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 FP SSCs subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.9 Reactor Coolant Pump Oil Collection

2.3.3.9.1 Summary of Technical Information in the Application

The purpose of the reactor coolant pump (RCP) oil collection system is to ensure that failure of the oil collection system does not lead to fire during normal operations or design basis accident conditions. The oil collection system consists of enclosures that encompass all externally located oil bearing components such that potential oil leakage from components will be contained and drained to an oil collection tank in a safe location. RCP oil collection components use the RCP system code.

An RCP oil collection system is provided for each pump to direct lube oil to a collection tank from pressurized and unpressurized leakage sites, such as lift pump and piping, overflow lines, lube oil cooler, oil fill and drain lines and plugs, flanged connection in oil lines, and lube oil reservoirs.

A gravity drain piping system transports any accumulated oil from the drip pan enclosures to oil collection tanks. There are two 200-gallon oil collection tanks. The tanks are located inside the Reactor Containment Building outside the biological shield wall. Each tank is vented and

provided with a flame arrester and a glass liquid level gauge to provide local indication of the existence of oil in the tank. Each tank is capable of collecting oil from one RCP oil lube system (195 gallons).

The RCP oil collection system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The RCP oil collection system has the following intended function for 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 FP (10 CFR 50.48).
- Provides the capability to control postulated fires in plant areas to maintain safe shutdown ability.

LRA Table 2.3.3-9 identifies the RCP oil collection system 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, UFSAR Sections 9.5.1.1.3 and 9.5.1.2.6, as well as the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff also reviewed FSAR Section 9.5.1, "Fire Protection System," which describes the FP program at WF3, and how it complies with the requirements of 10 CFR Section 50.48, "Fire protection," and the guidelines of Appendix A to Branch Technical Position (BTP), "Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1."

The staff also reviewed the following FP documents cited in the CLB listed in WF3 Operating License Condition 2.C (9):

- NUREG-0787, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," July 1981.
- NUREG-0787, Supplement 1, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," October 1981.
- NUREG-0787, Supplement 3, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," April 1982.
- NUREG-0787, Supplement 5, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," June 1982.
- NUREG-0787, Supplement 6, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," June 1984.
- NUREG-0787, Supplement 8 "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," December 1984.
- NUREG-0787, Supplement 10, "Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3," March 1985.

During its review, the staff evaluated the system functions described in the LRA and FSAR 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 2.3.3.9, 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 requests for RAIs as discussed below.

In RAI 2.3.3.9-1, by letter dated November 15, 2016, the staff noted that the following boundary drawing shows FP systems/components as not within the scope of license renewal (i.e., not colored in blue):

LRA Drawing	Systems/Components	Location
LRA-G161, sheet 4	Rotary transfer pumps and components	H7, H15

The staff requested that the applicant verify whether the FP systems/components listed above are within the scope of license renewal in accordance with 10 CFR 54.4(a) and whether they are subject to an AMR in accordance with 10 CFR 54.21(a)(1). If they are not within the scope of license renewal and are not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In response to RAI 2.3.3.9-1, by letter dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that rotary transfer pumps and components are shown on LRA drawing LRA-G164, sheet 4, at coordinates H7, and H15 not on LRA-G161, sheet 4. Further, the applicant stated that the rotary transfer pumps and components are used to add oil to the RCPs and are not a part of the oil collection system. The rotary transfer pumps and components do not have an intended function for license renewal. They are not required to maintain pressure boundary of the oil collection system.

Based on its review, the staff finds the applicant's response to the RAI 2.3.3.9-1 acceptable because the applicant interpreted the rotary transfer pumps and components in question to not be part of the RCPs' oil collection system and, therefore, excluded from the scope of license renewal and not subject to an AMR. The staff concludes their exclusion from the scope of license renewal is correct and that they are not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.9-1 is resolved.

2.3.3.9.3 Conclusion

Based on the results of the staff evaluation discussed in SER Section 2.3 and on a review of the LRA, FSAR, Section 9.5.1, "Fire Protection System," and Section 9A, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the RCP SSCs 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 RCP oil collection SSCs subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.3.10 Fuel Pool Cooling

2.3.3.10.1 Summary of Technical Information in the Application

The fuel pool cooling and purification (FS) system consists of a cooling loop and purification loop to maintain spent fuel pool temperature, purity, and clarity within design requirements.

The cooling portion is a closed loop system comprised of two half-capacity pumps and one full capacity heat exchanger cooled by the CCWS. The fuel pool water is drawn from the fuel pool near the surface through a strainer and is circulated by the fuel pool pumps through the fuel pool heat exchanger. From the outlet of the fuel pool heat exchanger (or backup fuel pool heat exchanger), the cooled fuel pool water is returned to the fuel pool.

The purification loop consists of the fuel pool purification pump, filter, ion exchanger, and strainers. The purification flow is drawn from the spent fuel pool through a strainer and circulated by the pump through a filter that removes particulates, then through an ion exchanger to remove ionic material, and finally through a strainer that prevents resin beads from entering the fuel pool. The connection to the refueling water storage pool through the purification loop also may be used to provide makeup to the fuel pool.

The spent fuel storage racks are freestanding and go wall-to-wall in the spent fuel pool and spent fuel cask storage area. The neutron absorbers and storage racks are subject to an AMR and are included in this review.

The FS system has the following intended functions for 10 CFR 54.4(a)(1):

- Remove decay heat from spent fuel assemblies.
- Support containment pressure boundary.
- Provide neutron absorption in the spent fuel pool.
- Provide structural support of fuel assemblies in the spent fuel pool.

The FS system has the following intended functions for 10 CFR 54.4(a)(2):

- Provide a backup makeup water supply to the spent fuel pool from a seismic Category I source.
- Provide for CS fluid drainage from the refueling cavity post-LOCA.
- Provide flood barrier for design basis flood.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The FS system has no intended functions for 10 CFR 54.4(a)(3).

LRA Table 2.3.3-10 identifies the FS 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 9.1.2 and 9.1.3, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance

with 10 CFR 54.21(a)(1). 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 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 FS 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 stated in 10 CFR 54.21(a)(1).

2.3.3.11 Nitrogen

2.3.3.11.1 Summary of Technical Information in the Application

The purpose of the nitrogen (NG) system is to provide nitrogen gas for normal plant operation and maintenance and for charging nitrogen accumulators associated with safety-related components.

The following major loads are supplied by the NG system:

- safety injection tanks
- reactor drain tank and quench tank
- accumulators used as backup air sources for safety-related air-operated valves
- gas surge tank, gas decay tanks, and equipment drain tank
- volume control tank
- boron management flash tank and holdup tanks
- demineralized water storage tank, primary water storage tank
- condensate storage tank
- SGs for blanketing and purging

The system withdraws liquid nitrogen from a storage tank via one of two positive displacement pumps. The liquid nitrogen is converted into a gas by a vaporizer unit and is stored in three high-pressure storage cylinders connected to the supply header. From the supply header, nitrogen is delivered directly to the main steam isolation valve (MSIV) nitrogen charging connections located just below the MSIV actuators and to a pressure control manifold. The pressure control manifold then reduces the nitrogen pressure for distribution to various plant loads.

The NG system has the following intended functions for 10 CFR 54.4(a)(1):

- Provide a reserve supply of compressed nitrogen (via accumulators and related components) to support safety functions of air-operated valves for safe shutdown and accident mitigation.
- Support pressure boundaries of safety-related systems that use nitrogen.
- Support containment pressure boundary.

The NG system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The NG system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (accumulators for air-operated valves) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (accumulators for air-operated valves) that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

LRA Table 2.3.3-11 identifies the NG 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 Section 9.3.9, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.11.3 Conclusion

Based on the results of the staff 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 nitrogen 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 stated in 10 CFR 54.21(a)(1).

2.3.3.12 Miscellaneous HVAC

2.3.3.12.1 Summary of Technical Information in the Application

The site HVAC systems with intended functions for license renewal are:

- cable vault and switchgear ventilation
- containment atmosphere release
- Fuel Handling Building HVAC
- Reactor Auxiliary Building HVAC
- Shield Building ventilation
- Turbine Building HVAC

LRA Section 2.3.3.12 states that the purpose of the miscellaneous HVAC systems is to maintain suitable temperature and humidity conditions within plant buildings for the operation of electrical equipment and the comfort and safety of plant personnel during normal and accident conditions. The HVAC systems also support post-accident containment heat removal, air purification, and air cleanup to keep offsite dose rates within limits.

LRA Section 2.3.3.12 states that the cable vault and switchgear ventilation system (SVS) maintains a suitable operating environment for electrical equipment and prevents the accumulation of a combustible concentration of hydrogen in the battery rooms during normal and accident conditions. The SVS also provides for smoke purge in the electrical areas in the event of a fire.

The SVS has the following intended function for 10 CFR 54.4(a)(1):

- Maintain a suitable operating environment for electrical equipment during accident conditions and to prevent the accumulation of a combustible concentration of hydrogen in the battery rooms during accident conditions.

The SVS has no intended functions for 10 CFR 54.4(a)(2).

The SVS has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

LRA Section 2.3.3.12 states that the purpose of the containment atmosphere release (CAR) system is to purge containment at low containment atmosphere pressure and serve as a long-term post-accident cleanup system.

The CAR system has the following intended function for 10 CFR 54.4(a)(1):

- Support post-accident fission product transport to the shield building annulus for removal by the Shield Building ventilation system and to support containment pressure boundary.

The CAR system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CAR system has no intended functions for 10 CFR 54.4(a)(3).

LRA Section 2.3.3.12 states that the fuel handling building HVAC (HVF) system provides a suitable environment for personnel, equipment, and controls in the Fuel Handling Building during normal operation and isolates the normal ventilation in the fuel handling area envelope in the event of a fuel handling accident.

The HVF system has the following intended function for 10 CFR 54.4(a)(1):

- Isolate the normal ventilation in the fuel handling area envelope in the event of a fuel handling accident.

The HVF system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The HVF system has no intended function for 10 CFR 54.4(a)(3).

LRA Section 2.3.3.12 states that the Reactor Auxiliary Building (RAB) HVAC (HVR) system consist of subsystems (RAB normal ventilation, RAB miscellaneous HVAC, RAB controlled ventilation area, emergency diesel ventilation, and RAB heating and ventilation (H&V) equipment room ventilation) that cools and heats parts of the RAB and maintains a desirable operating environment for equipment and provides comfort for personnel during normal operations. It also provides high efficiency filtration and iodine adsorption for air exhausted from the controlled ventilation areas following a design basis accident. In addition, it removes the heat associated with diesel operation from the EDG A and B rooms. It also maintains a suitable operating environment for the equipment located in the H&V equipment room during normal or accident conditions.

The HVR system has the following intended functions for 10 CFR 54.4(a)(1):

- Maintain an acceptable operating environment for safety-related equipment.
- Provide high efficiency filtration and iodine adsorption for all air exhausted from the controlled ventilation areas following a design basis accident.

The HVR system has the following intended functions for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The HVR system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (EDG ventilation, RAB H&V ventilation) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

LRA Section 2.3.3.12 states that the Shield Building ventilation (SBV) system controls the release and removal of fission products from the Shield Building annulus atmosphere and to maintain annulus pressure within the assumptions of the radiological analyses following a design basis accident.

The SBV system has the following intended functions for 10 CFR 54.4(a)(1):

- Control the release and removal of fission products from the Shield Building annulus atmosphere.
- Maintain annulus pressure within the assumptions of the radiological analyses.
- Support containment pressure boundary.

The SBV system has no intended functions for 10 CFR 54.4(a)(2) and (a)(3).

LRA Section 2.3.3.12 states that the Turbine Building ventilation (HVT) system provides a suitable operating environment for equipment and personnel during normal operation.

The HVT system has no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The HVT system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (switchgear room and battery room ventilation) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48)

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12, UFSAR Sections 6.2.3, 6.2.5, 6.5.1, 9.4.2, 9.4.3, and 9.4.4, as well as the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.12.3 Conclusion

Based on the results of the staff 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 Miscellaneous HVAC 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 stated in 10 CFR 54.21(a)(1).

2.3.3.13 Auxiliary Diesel Generator

2.3.3.13.1 Summary of Technical Information in the Application

The ADG is part of the site security system, which provides site access controls, surveillance equipment, and communications equipment used to maintain security at the site.

The ADG is a nonsafety-related skid-mounted turbocharged John Deere diesel engine powering a generator. The diesel has its own radiator and cooling water subsystem and, therefore, does not require an external cooling water supply. The diesel is electrically started from battery power. The ADG is normally in standby and operated only during testing.

The site security system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The site security system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

Diesel Fuel Oil. The purpose of the DFO system is to provide a supply of fuel oil for the operation of the two diesel-driven fire pumps and the ADG. The system includes tanks, piping, valves, instruments, and controls to support operation of the diesels.

The DFO system has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The DFO system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

LRA Table 2.3.3-13 identifies the ADG and DFO 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, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.13.3 Conclusion

Based on the results of the staff 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 ADG and DFO 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 stated in 10 CFR 54.21(a)(1).

2.3.3.14 Plant Drains

2.3.3.14.1 Summary of Technical Information in the Application

Sump Pump. LRA Section 2.3.3.14 states that the purpose of the sump pump (SP) system is to provide for the drainage of equipment, tanks, and wetted surfaces during normal plant operations, as well as anticipated large volume flows associated with abnormal or accident conditions. Components of the SP system support both radioactive and nonradioactive drainage systems.

Each area housing safety-related equipment is provided with an independent drainage system and attendant sump to preclude the flooding of such areas from other drainage systems. Water

discharged from fire suppression systems is handled by the floor drain systems, but this function is not credited for an internal flooding event and not credited for compliance with Appendix R.

Drainage from radiologically controlled areas is routed to the waste management systems.

The SP system includes safety-related components in the discharge flow path from the containment sump pumps that form part of the containment pressure boundary.

The DCT sump is provided with a set of motor-driven sump pumps, normally aligned to discharge to the CW system, to protect safety-related equipment in the area. Each cooling tower area is also provided with a portable diesel-driven sump pump and hoses that can be connected during extreme rainfall events to discharge water directly over the NPIS exterior floodwall. One portable DCT diesel-driven pump and one motor-driven sump pump per DCT sump are credited in the analyses for the probable maximum precipitation event to prevent flooding of safety-related equipment in the area. In the analysis for the standard project storm with the simultaneous occurrence of the operating-basis earthquake, a single diesel-powered sump pump per DCT sump is adequate to prevent flooding of safety-related equipment.

The SP system has the following intended function for 10 CFR 54.4(a)(1):

- Support containment pressure boundary.

The SP system has the following intended functions for 10 CFR 54.4(a)(2):

- Protect safety-related components during design basis rainfall and/or flooding events.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The SP system has no intended functions for 10 CFR 54.4(a)(3).

Sanitation. LRA Section 2.3.3.14 states that the purpose of the sanitation (SAN) system is to collect all sewage originating within the protected area and to transfer it to the municipal sanitary waste system. The system consists of lift stations and associated instrumentation, piping, and valves.

Sanitary collection facilities are located at several locations within the nuclear plant island structure (NPIS) boundaries to accept sanitary waste. The sanitary drain piping is vented to atmosphere via roof vents to allow gravity flow drainage through an NPIS wall penetration and functions as a flood barrier for the design basis flood.

The SAN system has no intended functions for 10 CFR 54.4(a)(1).

The SAN system has the following intended function for 10 CFR 54.4(a)(2):

- Support NPIS flood barrier.

The SAN system has no intended functions for 10 CFR 54.4(a)(3).

LRA Table 2.3.3-14 identifies the plant drains 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 2.4.2.3.3, 2.4.2.3.4, 3.6A.6.4.2.1, 9.3.3, and 9.2.4, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 plant drains 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 stated in 10 CFR 54.21(a)(1).

2.3.3.15 Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

2.3.3.15.1 Summary of Technical Information in the Application

This section summarizes the scoping and screening results for auxiliary systems based on 10 CFR 54.4(a)(2) because of the potential for physical interactions with safety-related equipment. Physical failures may be related to structural support or spatial interaction.

Each system has the following intended function:

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

For systems with intended functions that meet additional scoping criteria, the additional intended functions are noted in the descriptions below with a reference to the section where the affected components are evaluated.

Air Evacuation. The purpose of the air evacuation (AE) system is to remove air from the three condenser shells to create a vacuum in the condenser during plant startup and to maintain the vacuum by removing noncondensable gases and in-leaking air from the steam space of the three condenser shells during normal operation.

The system consists of three full-capacity condenser vacuum pump assemblies. Each assembly consists of one motor-driven, rotary, water-seal type, two-stage vacuum pump and seal water system. Each seal water system includes one centrifugal circulating pump, one heat exchanger, one separator and all necessary piping, valves, instruments, and electric devices. The system has no safety function.

Auxiliary Steam. The purpose of the auxiliary steam (AS) system is to distribute low pressure steam to plant auxiliary equipment. The AS system is supplied by either the main steam system or the auxiliary boiler system. The AS system supplies steam to the boric acid concentrator, the boric acid/waste concentrator, and the decontamination facility steamerette.

Chemical Feed. The purpose of the chemical feed (CF) system is to feed various chemicals into the secondary system to maintain and control the pH and to control the oxygen level for the protection of the SG tube integrity. The CF system includes a hydrazine feed system and an ammonia feed system, designed to feed a hydrazine solution and an aqueous ammonia solution, respectively, into the secondary system. The system also includes two independent chemical feed skids generically designed to feed alternate chemicals as water chemistry technology evolves.

Containment Atmosphere Purge. The purpose of the containment atmosphere purge (CAP) system is to reduce the level of radioactive contamination in the containment atmosphere to permit personnel access.

The CAP system consists of a containment purge air makeup unit and a separate containment purge exhaust that is connected to the exhaust portion of the Reactor Auxiliary Building HVAC (HVR) system. The CAP system includes no fans; motive force for the purge and makeup is provided by the HVR system exhaust fans. Apart from containment isolation valves and ducting on the makeup and exhaust lines, the CAP system has no safety function.

The makeup portion of the system provides air to the containment while purge operations are being conducted. The exhaust portion of the system draws air from inlet dampers, arranged in parallel, serving the general containment area and the refueling pool area inside containment.

In addition to the 10 CFR 54.4(a)(2) function described above, the CAP system has the following intended functions for 10 CFR 54.4(a)(1):

- Isolate the system on high radiation signal to support the fuel handling accident analysis.
- Support containment pressure boundary.

Gaseous Waste Management. The purpose of the gaseous waste management (GWM) system is to provide for collection, storage, sampling, and discharge of potentially radioactive gaseous waste. The GWM system consists of a gas surge tank, two waste gas compressors, three gas decay tanks, and the associated piping and valves required to collect gaseous waste and allow for release through the plant stack.

The vent gas collection header collects gas primarily from aerated vents of process equipment in the boric acid makeup and boron management systems, the liquid waste management system, the chemical and volume control system, and the fuel pool cooling and purification system.

Gaseous wastes are generated from reactor coolant degassing operations, processing of radioactive liquid wastes, and tank purging. These gases are collected and stored for decay in the gas surge tank before release to the environment. The waste gas compressors process the gas, taking suction on the gas surge tank and discharging to a gas decay tank. The gas decay tanks collect the waste gas discharged by the waste gas compressors and store it for approximately 60 days.

In addition to the 10 CFR 54.4(a)(2) function described above, the GWM system has the following intended functions for 10 CFR 54.4(a)(1):

- Support the pressure boundary of the CVC system.
- Support containment pressure boundary.

Leak Rate Testing. The purpose of the leak rate testing (LRT) system is to support integrated leak rate testing of the containment. The system includes pressure, temperature, and humidity instrumentation and test connection valves on station air system containment penetrations (penetrations 63 and 65) and the heating and ventilation instrumentation penetration (penetration 53). These LRT valves form part of the containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the LRT system has the following intended function for 10 CFR 54.4(a)(1):

- Support containment pressure boundary.

Liquid Waste Management. The purpose of the liquid waste management (LWM) system is to collect, store, process, monitor, and release liquid wastes while ensuring that all releases of radioactive materials, both in plant and to the environment, are within applicable requirements. The system manages both radioactive and nonradioactive liquid wastes from process systems, equipment drains, and sumps.

Post Accident Sampling. The purpose of the post accident sampling system is to permit sampling of the primary coolant and safety injection sump following an accident. Components of the post-accident sampling system are used to collect, cool, and analyze reactor coolant and safety injection sump samples. The system supports collection of diluted, undiluted, and full pressure liquid samples and gas grab samples. Post-accident sampling is not a safety function, and the system contains no safety-related components.

Potable Water. The purpose of the potable water system is to distribute water from the St. Charles Parish Water System throughout the plant site. The system provides potable water, both hot and cold, for drinking water, sanitary services, and emergency showers and eyewash stations. The distribution system also supplies makeup water to the fire water storage tanks and to the primary water treatment plant clearwell tank.

The potable water distribution system may be used as necessary to replenish water to the wet cooling tower basins following a tornado. However, because the availability of the potable water supply to the site is not assured following a tornado, this is not an intended function for the potable water supply. Potable water to the Reactor Auxiliary Building is supplied via a solenoid-operated isolation valve. The system has no safety-related components.

The PW system has the following intended function for 10 CFR 50(a)(2), which is included in this review:

- Isolate potable water from the Reactor Auxiliary Building during a seismic event or piping rupture.

Primary Makeup. The primary makeup (PMU) system provides storage and transfer capability necessary to supply demineralized water to primary plant systems, including the CVC system, boron management system, RCS (reactor drain tank and quench tank), and waste management systems. The PMU system consists of a 260,000-gallon primary water storage tank (PWST) located in the yard, two full-capacity primary water pumps, and associated system valves,

distribution piping, and instrumentation. PWST makeup comes from the demineralized water system. The PMU pumps take suction from the PWST to supply primary grade water to various plant loads.

In addition to the 10 CFR 54.4(a)(2) function described above, the PMU system has the following intended functions for 10 CFR 54.4(a)(1):

- Support the CVC system pressure boundary.
- Support containment pressure boundary.

Primary Sampling. The purpose of the primary sampling (PSL) system is to collect and analyze fluid and gaseous grab samples from the RCS, CVC system, safety injection system, and the PWST during all modes of operation without requiring access to the containment. The PSL system includes safety-related components that form parts of the pressure boundary of the CVC system and containment pressure boundaries.

The PSL takes samples and brings them to a common location in the primary sampling room PSL panel in the Reactor Auxiliary Building for analysis. The analyses performed on the samples determine fission and corrosion product activity levels, boron concentration, residual hydrazine, silica, lithium, pH and conductivity levels, crud concentration, dissolved gas concentration, and chloride.

In addition to the 10 CFR 54.4(a)(2) function described above, the PSL system has the following intended functions for 10 CFR 54.4(a)(1):

- Support the safety-related pressure boundaries of sampled systems.
- Support containment pressure boundary.

The PSL system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (safety-related systems pressure boundaries) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Radiation Monitoring. The radiation monitoring system consists of the area radiation monitoring (ARM) and process radiation monitoring (PRM) systems.

The purpose of ARM components is to inform operations personnel, both locally and in the main control room, of radiation levels in areas where ARM system detectors are located; to provide warning when abnormal radiation levels occur in specific plant areas; and to warn of possible equipment malfunctions. In the event of a fuel handling accident, the ARM system provides a signal to isolate the Fuel Handling Building and start the emergency ventilation system.

The purpose of PRM components is to sample, detect, measure, and record trends of radioactive concentrations in liquid process systems, ventilation systems, and airborne or liquid effluents. PRM components support the pressure boundary of monitored systems.

The containment atmosphere radiation monitor (PRM-IR-0100Y) takes particulate, iodine, and gas readings of the containment atmosphere to help detect identified or unidentified leaks in the RCS pressure boundary. While the rad monitor itself, and certain components associated with the monitor, are classified as safety-related, they do not perform a function in accordance with the criteria of 10 CFR 54.4(a)(1) and are, therefore, not within the scope of license renewal for 10 CFR 54.4(a)(1). This rad monitor is associated with a containment penetration, and the

piping and valves associated with the penetration perform a safety function in accordance with the criteria of 10 CFR 54.4(a)(1). The plant stack monitors (PRM-IRE-0100.1, -0100.2) provide indication of the activity levels of radioactive materials released to the environs, so that determination of the total release is possible. The component cooling water radiation monitors provide for early detection of radioactivity leakage into normally nonradioactive systems.

In addition to the 10 CFR 54.4(a)(2) function described above, the radiation monitoring system has the following intended functions for 10 CFR 54.4(a)(1):

- Support isolation of containment purge in the event of a fuel handling accident.
- Support CCWS pressure boundary.
- Support containment pressure boundary.

Resin Waste Management. The purpose of the resin waste management (RWM) system is to collect and store spent radioactive ion exchanger resin from the various process demineralizers and to transfer resins to the portable solidification and/or dewatering system. The RWM system includes a spent resin tank, spent resin transfer pump, spent resin dewatering pump, spent resin strainers, and associated valves, piping and controls.

In addition to the 10 CFR 54.4(a)(2) function described above, the RWM system has the following intended function for 10 CFR 54.4(a)(2):

- Support NPIS flood barrier.

Secondary Sampling. The purpose of the secondary sampling system is to collect steam and water samples from the secondary cycle, the makeup demineralizer, the blowdown demineralizer, condensate transfer pump discharge, and the SGs, and to bring them to a common location in the secondary lab and sampling room for analysis.

The constant temperature bath system components provide constant temperature cooling water used to cool secondary plant samples. The system includes coolers, pumps, a sample recovery tank, piping, valves, and instrumentation and controls. The secondary sampling system includes safety-related components that support the pressure boundary of the main steam system.

In addition to the 10 CFR 54.4(a)(2) function described above, the secondary sampling system has the following intended functions for 10 CFR 54.4(a)(1):

- Support the safety-related pressure boundary of main steam system.
- Support containment pressure boundary.

The secondary sampling system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (main steam pressure boundary) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Solid Waste Management. The purpose of the solid waste management system is to process, package, and store low-level solid radioactive wastes for subsequent shipment and offsite burial.

In addition to the 10 CFR 54.4(a)(2) function described above, the SWM system has the following intended function for 10 CFR 54.4(a)(2):

- Support NPIS flood barrier.

Turbine Building Cooling Water. The purpose of the Turbine Building cooling water system is to provide a heat sink for power cycle equipment during normal operation and shutdown conditions. The turbine building cooling water system is a closed loop system that uses treated demineralized water to remove heat from the turbine auxiliaries and other components located within the Turbine Building. The water is circulated by two turbine cooling water pumps, and the heat removed via two turbine cooling water heat exchangers is transferred to the CW system.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15.2. This section included multiple systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) that are not described elsewhere in the application. The table below includes the system and the FSAR section reviewed. These sections were reviewed, as well as the license renewal boundary drawings using the evaluation methodology discussed in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

System	FSAR Section Reviewed
Air Evacuation	10.4.2
Auxiliary Steam	None
Boron Management	11.2.2.1
Chemical Feed	10.4.10
Containment Atmosphere Purge	9.4.5.3
Gaseous Waste Management	11.3
Leak Rate Testing	Figure 3.8-3
Liquid Waste Management	11.2
Post Accident Sampling	9.3.8
Potable Water	9.2.4
Primary Makeup	9.2.3
Primary Sampling	9.3.2
Radiation Monitoring	7.6.1.5 11.5 12.3.4
Resin Waste Management	11.4.5
Secondary Sampling	9.3.2
Solid Waste Management	11.4
Turbine Building Cooling Water	9.2.7

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.3.3.15.3 Conclusion

Based on the results of the staff 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 components of the systems listed in the table above, 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 stated in 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

LRA Section 2.3.4 identifies the steam and power conversion systems SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the steam and power conversion systems in the following LRA sections:

- LRA Section 2.3.4.1, “Condensate Makeup and Storage”
- LRA Section 2.3.4.2, “Emergency Feedwater”
- LRA Section 2.3.4.3, “Main Feedwater”
- LRA Section 2.3.4.4, “Main Steam”
- LRA Section 2.3.4.5, “Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)”

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 Makeup and Storage

2.3.4.1.1 Summary of Technical Information in the Application

LRA Section 2.3.4.1 states that the purpose of the condensate makeup and storage (CMU) system is to makeup water to, and discharge water from, the condensate system and to store and transfer demineralized water for initial fill and makeup to various normally nonradioactive systems throughout the plant. The CMU system includes the demineralized water system. The CMU system includes two sources of condensate makeup: the safety-related condensate storage pool in the Reactor Auxiliary Building and the nonsafety-related condensate storage tank in the yard. The condensate storage tank and demineralized water tank share a distribution subsystem comprised of pumps, piping, and valves with component identification numbers that use the CCWS (component cooling water), CD (condensate), CMU, and DW (demineralized water) system codes for license renewal. These components are included with the CMU system review.

The condensate storage pool is the water supply for the EFW pumps. The condensate storage pool, CCWS makeup pumps, and the associated distribution subsystem provide makeup to the CCWS. They can also distribute makeup to the EDG jacket water standpipes, the essential chiller expansion tanks, and the fuel pool makeup fill and purification loop.

The nonsafety-related condensate storage tank, demineralized water tank, condensate storage tank pumps, condensate transfer pump, hotwell transfer pump, and the associated distribution subsystem provide demineralized water to various systems and components, including the

condenser hotwell, the auxiliary boiler, the chemical feed system, AFW pump, condensate storage pool, refueling water storage pool, and ACC wet cooling towers.

The CMU system has the following intended functions for 10 CFR 54.4(a)(1):

- Provide a source of makeup to the CCWS, the EDGs, and the essential chilled water system.
- Provide water for the EFW pumps.
- Support containment pressure boundary.

The CMU system has the following intended functions for 10 CFR 54.4(a)(2):

- Provide a makeup water supply to the spent fuel pool.
- Provide flood barrier for design basis flood.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CMU system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (EFW water supply and makeup to other safe shutdown equipment) that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
- Perform a function (EFW water supply) that demonstrates compliance with the Commission’s regulations for SBO (10 CFR 50.63).

LRA Table 2.3.4-1 identifies the CMU 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 9.1.3.1.e, 9.2.3.2, 9.2.6, and 10.4.9.2, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 CMU 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 stated in 10 CFR 54.21(a)(1).

2.3.4.2 Emergency Feedwater

2.3.4.2.1 Summary of Technical Information in the Application

LRA Section 2.3.4.2 states that the purpose of the EFW system is to provide cooling water to the SGs for the removal of decay heat from the reactor during emergency situations when the main feedwater system is not available. The system can also be used during emergency situations to cool down the RCS to the temperature and pressure required for shutdown cooling system operation. The EFW system consists of two half-capacity motor-driven pumps, a full-capacity steam turbine-driven pump, and the associated piping and valves.

The three pumps take suction from a common suction header supplied by two lines from the condensate storage pool. The pumps discharge to a common supply header. Each EFW pump can be isolated by suction and discharge valves that are normally locked open. Water from the discharge header is then delivered to each main feedwater header through an arrangement of control and isolation valves. The discharge of the EFW pumps can supply either or both SGs.

The EFW system has the following intended functions for 10 CFR 54.4(a)(1):

- Provide cooling water to one or both SGs for the removal of decay heat from the reactor during emergency situations when the main feedwater system is not available.
- Support containment pressure boundary.

The EFW system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The EFW system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

LRA Table 2.3.4-2 identifies the EFW system component types 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 and UFSAR Section 10.4.9, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with

intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 EFW 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 stated in 10 CFR 54.21(a)(1).

2.3.4.3 Main Feedwater

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 states that the purpose of the main feedwater (FW) system is to supply water from the condensate system to the SGs at the proper pressure, temperature, and flow rate to maintain SG water level under all plant operating conditions. The FW system consists of two turbine-driven pumps, three high-pressure heaters, regulating valves, isolation valves, and other miscellaneous valves and piping.

The condensate system supplies water to the suction of the feedwater pumps. Each feedwater pump discharges to the combined discharge header, which feeds three parallel high-pressure feedwater heaters. The heaters discharge to a single header that splits to supply each SG.

When required, automatic isolation of the steam generators is provided by the FW isolation valves with backup from the FW regulating valves and startup feedwater regulating valves.

The FW system has the following intended functions for 10 CFR 54.4(a)(1):

- Provide automatic isolation of the feedwater flow to the SGs.
- Support the delivery of EFW to the SGs.
- Support containment pressure boundary.

The FW system has the following intended functions for 10 CFR 54.4(a)(2):

- Provide backup automatic isolation of the feedwater flow to the SGs.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The FW system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (EFW system support, FW isolation) that demonstrates compliance with the Commission’s regulations for fire protection (10 CFR 50.48).
- Perform a function (EFW system support) that demonstrates compliance with the Commission’s regulations for SBO (10 CFR 50.63).

LRA Table 2.3.4-3 identifies the FW system component types 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 and UFSAR Section 10.4.7, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 FW 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 stated in 10 CFR 54.21(a)(1).

2.3.4.4 Main Steam

2.3.4.4.1 Summary of Technical Information in the Application

LRA Section 2.3.4.4 states that the purpose of the main steam (MS) system is to convey steam from the SGs to the high-pressure turbine and to other auxiliary equipment for power generation. The MS system provides for overpressure protection for the SGs and main steam lines, discharges steam to the condenser or atmosphere when the main turbine is unavailable, and provides for isolation of the main steam lines when required. During full power operating conditions, main steam normally supplies the high-pressure main turbine, the moisture separator reheaters, and the AS system. During reduced power conditions, main steam replaces or supplements steam to the feedwater pump turbines and the gland seal steam system.

Downstream of the SGs, each main steam line has a flow element, six safety relief valves, a power-operated atmospheric relief valve, and a main steam isolation valve (MSIV). Downstream of the MSIVs, the main steam lines supply the high-pressure turbine, the gland seal system, the AS system, and a common main steam header. Lines from the main steam header supply the moisture separator reheaters, the SG feedwater pump turbines, and the steam bypass system.

The MS system has the following intended functions for 10 CFR 54.4(a)(1):

- Isolate the SGs from the non-safety portions of the main steam system during emergency conditions by automatic closure of the MSIVs.

- Dissipate heat generated and accumulated in the nuclear steam supply system to atmosphere during emergency conditions by operation of the main steam safety valves and/or the atmospheric dump valves until shutdown cooling can be initiated.
- Provide main steam line and SG overpressure protection.
- Provide redundant flow paths for the steam supply to EFW pump turbine.
- Support containment pressure boundary.

The MS system has the following intended functions for 10 CFR 54.4(a)(2):

- Prevent blowdown of the unaffected SG during a main steam line break event when the fault is upstream of one MSIV and the single failure is the failure of the other SG MSIV to close.
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The MS system has the following intended functions for 10 CFR 54.4(a)(3):

- Perform a function (relief valves, MSIVs, support EFW) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (support EFW) that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

Blowdown. The purpose of the SG blowdown (BD) system is to control the chemical composition of water in the SG shells. Two blowdown lines, one from each SG, exit the containment through their own penetrations. Two air-operated containment isolation valves, one inside and one outside, are located in each of the lines exiting containment. Downstream of the containment isolation valves the water is processed through mixed bed demineralizers or processed as waste and returned to the secondary system.

The portion of the BD system from the SGs to and including the outside containment isolation valves comprises an extension of the SG boundary.

The BD system has the following intended functions for 10 CFR 54.4(a)(1):

- Support the SG pressure boundary.
- Support containment pressure boundary.

The BD system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The BD system has the following intended function for 10 CFR 54.4(a)(3):

- Perform a function (blowdown isolation) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Reheat Steam. The purpose of the reheat steam (RS) system is to reheat and dry the high- pressure turbine exhaust by means of the moisture-separator reheaters and to provide the reheated steam to the low pressure turbines. Two horizontal axis, cylindrical shell combined moisture separator and reheater assemblies are installed in the steam lines connecting the high-pressure and low-pressure turbines.

Steam from the high-pressure turbine passes up through the moisture separators. The water separated from the steam is drained from the moisture separator reheaters to the moisture separator reheater shell drain tanks, which drain into the intermediate pressure feedwater heaters. The steam then flows through the reheater section of the moisture separator reheater, where it is heated by a steam tube bundle. Main steam is supplied to this tube bundle from the main steam line. The condensate from this tube bundle is drained to the moisture separator reheater drain collector tank, which drains into the high-pressure feedwater heaters. Steam flow from the moisture separator reheaters is then directed to the low pressure turbines.

The RS system has no intended functions for 10 CFR 54.4(a)(1).

The RS system has the following intended function for 10 CFR 54.4(a)(2):

- Support preventing blowdown of the unaffected SG during a main steam line break event when the fault is upstream of one MSIV and the single failure is the failure of the other SG MSIV to close.

The RS system has no intended functions for 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 10.2.2.2.4, 10.3, 10.4.4, and 10.4.8, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 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 stated in 10 CFR 54.21(a)(1).

2.3.4.5 Condensate

2.3.4.5.1 Summary of Technical Information in the Application

LRA Section 2.3.4.5 states the purpose of the condensate (CD) system is to supply purified and preheated water to the feedwater pumps via the condensate polishers and low-pressure and intermediate-pressure feedwater heaters. The system also supplies water to the SG BD system, feedwater pump glands, and condenser exhaust hood spray.

Components in the condensate system include: the main condenser, condensate pumps, gland steam condenser, low-pressure feedwater heaters, and intermediate-pressure feedwater heaters. The condensate system also includes the components in the feedwater flow path from the main condenser hotwell up to the feedwater pump suction, not including the condensate polisher system components.

Condensate flow begins at the main condenser hotwell. The condensate pumps discharge water through the polishing demineralizers from the main condenser. A portion of the flow then passes through the tubes of the gland steam condenser, which receives the exhaust steam from the glands of the main turbine and the feedwater pump turbines and condenses it back into water. After the gland steam condenser, the condensate flows through three parallel strings of low-pressure feedwater heaters and then through the three parallel strings of intermediate-pressure feedwater heaters. Water exits the intermediate-pressure heaters and is combined with the discharge of the heater drain pumps (system FHD). The total water flow is sent to the combined suction of the SG feed pumps.

The CD system has no intended functions for 10 CFR 54.4(a)(1).

The CD system has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

The CD system has no intended functions for 10 CFR 54.4(a)(3).

LRA Table 2.3.4-5 identifies the CD 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 and UFSAR Section 10.4.7, as well as the license renewal boundary drawings using the evaluation methodology discussed 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 included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). 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 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 CD 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 stated in 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

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

- LRA Section 2.4.1, "Reactor Building"
- LRA Section 2.4.2, "Nuclear Plant Island Structure"
- LRA Section 2.4.3, "Turbine Building and Other Structures"
- LRA Section 2.4.4, "Bulk Commodities"

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 Reactor Building

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 states the purpose of the Reactor Building is to support and protect the enclosed vital mechanical and electrical equipment, including the reactor vessel, the RCS, the SGs, pressurizer, auxiliary, and ESF features systems required for safe operation and shutdown of the reactor. The safety function of the Reactor Building is to limit the release of radioactive fission products following an accident, thereby limiting the dose to the public and control room operators. The Reactor Building structure also provides physical support for itself, the RCS, ESF, and other systems and equipment located within the structure. In addition, the Reactor Building supports the plant stack and also serves as a reliable final barrier against the escape of fission products to ensure that leakage limits are not exceeded and fission product releases are within 10 CFR Part 20 requirements during normal plant operation and 10 CFR 50.67 requirements during the postulated design basis accidents.

LRA Table 2.4-1 identifies the components subject to an AMR for the Reactor Building by component type and intended function.

The Reactor Building has the following intended functions for 10 CFR 54.4(a)(1):

- Provide physical support, shelter, and protection for safety-related equipment within the scope of license renewal.
- Provide primary containment to limit the release of radioactive materials so that offsite doses from a postulated design basis accident are below the guideline values of 10 CFR 50.67.

The Reactor Building has the following intended function for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related structural components such that safety functions are not affected.

The Reactor Building has the following intended functions for 10 CFR 54.4(a)(3):

- Provide shelter, support, and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal.
- Houses equipment credited in the safe shutdown analysis for fire protection (10 CFR 50.48), SBO (10 CFR 50.63), and ATWS (10 CFR 50.62).

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1, UFSAR Sections 3.8.1 through 3.8.4, 6.1.3, 6.2.2.2.2.1 and 9.3.3.2.1.1, Figures 1.2-17 through 1.2-22 and 3.8-31, 3.8-40 and 3.8-44, as well as the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.4 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those

components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.4.1.3 Conclusion

Based on the results of the staff 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 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 stated in 10 CFR 54.21(a)(1).

2.4.2 *Nuclear Plant Island Structure*

2.4.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2 states the purpose of the nuclear plant island structure (NPIS) is to provide a common structure for the Reactor Building, Reactor Auxiliary Building, Fuel Handling Building, and CCWS structure, as well as to provide a common foundation mat for these structures.

LRA Table 2.4-2 identifies the components subject to an AMR for the NPIS by component type and intended function.

The NPIS has the following intended function for 10 CFR 54.4(a)(1):

- Provide physical support, shelter, and protection for safety-related systems, structures, and components within the scope of license renewal.

The NPIS has the following intended function for 10 CFR 54.4(a)(2):

- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1).

The NPIS has the following intended function for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon 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).

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4, UFSAR Sections 2.4.1.1, 3.4.1, 3.8.3.1.3, 3.8.4.1.2, 3.8.4.1.3, 3.8.4.1.4, 3.8.5.1, 9.1.2.2, 9.1.4.2.2.4, 9.2.2.2.1, 9.2.5.2, 9.5.1, and 10.4.9, and Figures 1.2-15, 1.2-16, 1.2-24, 1.2-25, 3.8-1, 3.8-31, 3.8-45, 3.8-42, and 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 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.4.2.3 Conclusion

Based on the results of the staff 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 NPIS 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 stated in 10 CFR 54.21(a)(1).

2.4.3 *Turbine Building and Other Structure*

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 states the purpose of the Turbine Building is to provide support and housing for the turbine-generator and associated auxiliaries. Other structures include:

- battery house, 230kV switchyard
- control house, 230kV switchyard
- fire pump house
- fire water storage tank foundations
- manholes, handholes, and duct banks
- transformer and switchyard support structures and foundations

LRA Table 2.4-3 identifies the components subject to an AMR for the NPIS by component type and intended function.

LRA Section 2.4.3 states that the purpose of the battery house is to provide a protected area for the switchyard batteries in support of SBO.

The battery house, 230kV switchyard has no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The battery house, 230kV switchyard has the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulation for SBO (10 CFR 50.63).

LRA Section 2.4.3 states that the purpose of the control house is to provide a protected area for the relay panels that control commodities within the switchyard.

The control house, 230kV switchyard has no intended functions of for 10 CFR 54.4(a)(1) and (a)(2).

The control house, 230kV switchyard has the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for SBO (10 CFR 50.63).

LRA Section 2.4.3 states that the purpose of fire pump house is to provide space for three horizontal centrifugal fire pumps (one motor-driven and two diesel-driven) and a jockey pump for fire main pressure maintenance and shelter for the security diesel.

The fire pump house has no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The fire pump house has the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63).

LRA Section 2.4.3 states that the purpose of the fire water storage tank foundations is to provide structural support for two fire water storage tanks.

The fire water storage tank foundations have no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The fire water storage tank foundations have the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for fire protection (10 CFR 50.48).

LRA Section 2.4.3 states that the purpose of the manholes, handholes, and duct banks is to provide structural support, shelter, and protection to systems, structures, and components that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulated events and that are housed within these structures during normal plant operation, and during and following postulated design basis accidents.

The manholes, handholes, and duct banks have no intended functions for 10 CFR 54.4(a)(1).

The manholes, handholes, and duct banks have the following intended functions for 10 CFR 54.4(a)(2):

- Provide physical support, shelter, and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1).

The manholes, handholes and duct banks have the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for fire protection (10 CFR 50.48) and SBO (10 CFR 50.63).

LRA Section 2.4.3 states that the purpose of the transformer and switchyard support structures and foundations is to provide structural support to systems, structures, and components that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout, specifically those necessary to recover offsite power following a station blackout.

There are no intended functions of the transformer and switchyard support structures and foundations for 10 CFR 54.4(a)(1) and (a)(2).

The transformer and switchyard support structures and foundations have the following intended functions for 10 CFR 54.4(a)(3):

- Provide physical support, shelter, and protection for systems, structures, and components relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

2.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4, UFSAR Sections 1.2.2.4, 8.2, 9.5.1.2.2, 9.5.1.3, and Figures 8.1-4 and 8.1-5, as well as the license renewal boundary drawings using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information

2.4.3.3 Conclusion

Based on the results of the staff 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 and Other Structure 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 stated in 10 CFR 54.21(a)(1).

2.4.4 *Bulk Commodities*

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4 provides scoping and screening results of structures. Specific structures are included in the review in LRA Sections 2.4.1, “Reactor Building,” 2.4.2, “Nuclear Plant Island Structure,” and 2.4.3, “Turbine Building and Other Structures.” LRA Tables 2.4-1, 2.4-2, and 2.4-3 list all credited fire barrier types and license renewal intended functions.

LRA Section 2.4.4 states that bulk commodities subject to subject to aging management review are structural components or commodities that perform or support intended functions of in-scope SSCs. The LRA states that the bulk commodities are designed to support both safety-related and nonsafety-related equipment during normal and accident conditions in the event of external events (tornadoes, earthquakes, floods, missiles) and internal events (LOCA, pipe breaks).

Bulk commodities are structural components that support the various intended functions performed by the structures in which they are located.

The bulk commodities have the following intended function for 10 CFR 54.4(a)(1):

- Provide support, shelter, and protection for safety-related equipment and nonsafety-related equipment within the scope of license renewal.

The bulk commodities have the following intended functions for 10 CFR 54.4(a)(2):

- Maintain integrity of nonsafety-related structural components so that safety functions are not affected.
- Provide support and protection for equipment credited in the Appendix R safe-shutdown analysis and for FP (10 CFR 50.48).

LRA Table 2.4-4 identifies bulk commodity component types that are within the scope of license renewal and subject to an AMR.

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 and the relevant LRA drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

The staff also reviewed FSAR Section 9.5.1, “Fire Protection System,” which describes the FP program at WF3, and how it complies with the requirements of 10 CFR Section 50.48, “Fire protection,” and the guidelines of Appendix A to Branch Technical Position (BTP), “Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1.”

The staff also reviewed the following FP documents cited in the CLB listed in WF3, Operating License Condition 2.C(9):

- NUREG-0787, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” July 1981.
- NUREG-0787, Supplement 1, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” October 1981.

- NUREG-0787, Supplement 3, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” April 1982.
- NUREG-0787, Supplement 5, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” June 1982.
- NUREG-0787, Supplement 6, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” June 1984.
- NUREG-0787, Supplement 8 “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” December 1984.
- NUREG-0787, Supplement 10, “Safety Evaluation Report Related to the Operation of Waterford Steam Electric Station, Unit 3,” March 1985.

During its review, the staff evaluated the system functions described in the LRA and FSAR, 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 2.4.4, 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 requests for RAIs as discussed below.

In RAI 2.4.4-1, by letter dated November 15, 2016, the staff stated that Tables 2.4-4 and 3.5.2-4 of the LRA do not include the following fire protection components:

- fire damper housings
- smoke and heat vent housings

The staff requested that the applicant verify whether the FP 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 response to RAI 2.4.4-1, by letter dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that “fire damper housings” and “smoke and heat vent housings” are within the scope of WF3 license renewal in accordance with 10 CFR 54.4(a) and are subject to an AMR in accordance with 10 CFR 54.21(a)(1). As discussed in LRA Section 2.3.3.8, where the fire dampers are mounted in a wall, the housings are evaluated as structural commodities, and where fire dampers are installed in ductwork, they are included in the evaluation of the related, HVAC system. The in-wall fire damper housings are included in the structural AMRs as miscellaneous steel as part of component type “Fire protection components - miscellaneous steel including framing steel, curbs, vents and louvers, radiant energy shields, tray covers.” This item is included in LRA Table 2.4-4. Where fire damper housings are in duct work, they are covered in the HVAC systems as the component type “damper housing” as shown in the LRA Section 2.3 tables (e.g., Tables 2.3.3-6 and 2.3.3-12).

Smoke and heat vent housings are included in structural AMRs as “vents and louvers” as part of component type “Fire protection components - miscellaneous steel including framing steel,

curbs, vents and louvers, radiant energy shields, tray covers." As discussed above, this item is included in LRA Table 2.4-4.

Based on its review, the staff finds the applicant's response to RAI 2.4.4-1 acceptable because the applicant clarified that fire dampers are included in LRA Section 2.3.3.8. The housings of wall mounted fire dampers and smoke and heat vent housings are evaluated as structural commodities, in structural AMRs as miscellaneous steel as part of component type "FP components - miscellaneous steel including framing steel, curbs, vents and louvers, radiant energy shields, tray covers," in LRA Table 2.4-4. 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 2.4.4-1 is resolved.

2.4.4.3 Conclusion

Based on the results of the staff evaluation discussed in SER Section 2.3 and on a review of the LRA, FSAR, Section 9.5.1, "Fire Protection System," and Section 9A, and license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the fire barrier commodities SSCs 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 fire barrier commodities SSCs subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Control Systems

This section documents the staff's review of the applicant's scoping and screening results for electrical 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 FSAR for each electrical and I&C system to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a).

After its review of the scoping results, the staff evaluated the applicant's screening results. For those 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 electrical and I&C systems. The applicant's scoping method includes all plant electrical and I&C components. Evaluation of electrical systems includes electrical and I&C components in mechanical systems. The applicant states that default inclusion of plant electrical and I&C systems in the scope of license renewal is the bounding approach used for the scoping of electrical systems. The applicant also states that the basic philosophy used in the electrical and I&C components integrated plant assessment (IPA) is that components are included in the review unless specifically screened out. When used with the plant spaces approach for review of plant equipment, this method eliminates the need to identify each unique component and its specific location and prevents improper exclusion of components from an AMR.

For the electrical and I&C components identified as within the scope of license renewal, the applicant grouped them into component/commodity groups. The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified. The applicant stated that during the IPA screening process, commodity groups and specific plant systems were eliminated from further review if they did not perform or support an intended function. The applicant applied the screening criteria in 10 CFR 54.21(a)(1)(i) and 10 CFR 54.21(a)(1)(ii) to this list of component groups to identify those that perform an intended function without moving parts or without a change in configuration or properties and to remove the component groups that are subject to replacement based on a qualified life or specified time period. LRA Table 2.5-1 identifies structure and/or components that are within the scope of license renewal and subject to an AMR.

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5, UFSAR Sections 7 and 8, and the license renewal boundary drawings, using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems." During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant had 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 had not omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

General Design Criterion 17 of 10 CFR Part 50, Appendix A, requires two physically independent circuits supply electric power from the transmission network to the onsite electric distribution system to minimize the likelihood of simultaneous failure. Additionally, as described

in the guidance provided in SRP-LR Section 2.5.2.1.1, or purposes of the license renewal rule, the staff has determined that the following is true:

> The plant system portion of the offsite power system that is used to connect the plant to the offsite power source meeting the requirements of 10 CFR 54.4(a)(3). This path typically includes the switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical system, and the associated control circuits and structures.

According to this guidance, ensuring that the appropriate offsite power system long-lived passive SSCs that are part of this circuit path are subject to an AMR will assure that the bases underlying the SBO requirements are maintained over the period of the extended operation. The applicant included the complete circuits between the onsite circuits and up to and including switchyard breakers (which includes the associated controls and structures) supplying the startup transformers within the scope of license renewal. Consequently, the staff concludes that the scoping is consistent with NRC guidance.

The staff reviewed LRA Section 2.5, UFSAR Sections 7 and 8, and the license renewal boundary drawings, using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5 to determine if the applicant failed to identify any components within the scope of license renewal.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has included within the scope of license renewal all components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as being within the scope of license renewal to verify that it has included all passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). On the basis of its review, the staff did not identify the need for additional information.

2.5.1.3 Conclusion

Based on the results of the staff evaluation discussed in SER Section 2.5 and on a review of the LRA, UFSAR, and license renewal boundary drawings, the staff concludes that the applicant appropriately identified the electrical and I&C 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 stated in 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 (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).

The staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses in accordance with the CLB, and any changes to the CLB, in order to comply with 10 CFR 54.21(a)(1), the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Waterford Steam Electric Station, Unit 3 (WF3) by the staff of the United States (U.S.) Nuclear Regulatory Commission ("NRC" or "the staff").

In Appendix B to its license renewal application (LRA), as amended during the review, Entergy Operations, Inc. ("Entergy" or "the applicant"), described the 41 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 the following:

- systems, structures, and components (SSCs)
- SC materials
- environments to which the SCs are exposed
- aging effects of the materials and environments
- AMPs credited with managing or monitoring the aging effects
- recommendations for further applicant evaluations of aging management for certain component types

The staff's review was performed 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 or SRP), dated December 2010; and the guidance provided in the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMPs during the weeks of July 11, 2016, and July 25, 2016, as described in the Audit Report entitled, "Aging Management Programs Audit Report Regarding Waterford Steam Electric Station, Unit 3 License Renewal Application Review," dated May 9, 2017 (ADAMS Accession No. ML17054C529). 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, and the need for formal correspondence between the staff and the applicant is reduced, which results in a more efficient review.

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 the results of AMR information in the following two table types:

(1) Table 1s: Table 3.x.1, where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, and "1" indicates that this table type is the first in LRA Section 3.

(2) Table 2s: Table 3.x.2-y, where "3" indicates the LRA section number, "x" indicates the subsection number from the GALL Report, "2" indicates that this table type is the second in LRA Section 3, and "y" indicates the system table number.

In its Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

Each Table 3.x.1 (Table 1) provides a summary comparison of how the facility aligns with the corresponding tables in the SRP-LR. The table is essentially the same as Tables 1 through 6 in the SRP-LR, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column is a means for the staff reviewer to cross-reference Table 2s with Table 1s. In the "Discussion" column, the applicant provided clarifying information. The following are examples of information that might be contained within this column:

- further evaluation recommended (information or reference to where that information is located)
- name of a plant-specific program

- exceptions to the GALL Report assumptions
- discussion of how the line is consistent with the corresponding AMR item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding AMR 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 2s

Each Table 3.x.2-y (Table 2) provides the detailed AMR results for those components identified in LRA Section 2 as subject to an AMR. The LRA contains a Table 2 for each of the systems or system grouping (e.g., reactor coolant system (RCS), engineered safety features (ESF), and auxiliary systems). For example, the ESF group contains tables specific to the containment spray system, containment isolation system, and emergency core cooling system. Each Table 2 consists of the following 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 described in LRA Table 2.0-1.

(3) Material – The third column lists the particular construction material(s) for the component type.

(4) Environment – The fourth column lists the environments to which the component types are exposed. Internal and external service environments are indicated with a list of these environments in LRA Tables 3.0-1, 3.0-2, and 3.0-3.

(5) Aging Effect Requiring Management (AERM) – 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 (AMPs) – The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.

(7) The GALL Report 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 were no corresponding items in the GALL Report, the applicant left the column blank to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

(8) Table 1 Item – The eighth column lists the corresponding summary item from LRA Table 1. If the applicant's LRA Table 2 AMR result item is consistent with the GALL Report, the Table 1 AMR 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 AMR item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted the following three types of evaluations of the AMR items 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 confirm consistency. 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 addressed 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) <u>Scope of Program</u> – Scope of the program should include the specific SCs subject to an AMR for license renewal.

(2) <u>Preventive Actions</u> – 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 AMR items identified by the applicant align with the GALL Report AMR items. For a given AMR item 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 AMR items 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 determined, based on its review, whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant described 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 to confirm the validity of the AMR item 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. However, the AMP takes some exceptions to the GALL Report AMP. The staff audited these AMR items to verify consistency with the GALL Report and to confirm the validity of each AMR item for the site-specific conditions. The staff confirmed that the identified exceptions to the GALL Report AMP have been reviewed and accepted, and that the applicant's AMP is otherwise consistent with the GALL Report.

Note C indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect. However, the component is different from that listed in the GALL Report. In addition, the AMP is consistent with the GALL Report. This note indicates that the applicant was unable to find an AMR item for the component in the GALL Report; however, the applicant identified a GALL Report AMR item with a different component but 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 and to confirm the validity of each AMR item for the site-specific conditions. The staff also determined whether the AMR item of the different component was applicable to the component under review.

Note D indicates that the AMR item is consistent with the GALL Report for material, environment, and aging effect. However, the component is different from that in the GALL Report. In addition, the AMP takes one or more exceptions to the GALL Report AMP. The staff audited these items to verify consistency with the GALL Report and to confirm the validity of each AMR item for the site-specific conditions. The staff also determined whether the AMR item of the different component was applicable to the component under review. The staff confirmed that the identified exceptions to the GALL Report AMP have been reviewed and accepted, and that the applicant's AMP is otherwise consistent with the GALL Report.

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 FSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the final safety analysis report (FSAR) supplement, which summarizes the applicant's programs

and activities for managing aging effects for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff used the LRA, LRA supplements, the SRP-LR, the GALL Report, and request for additional information (RAI) responses.

During the onsite audit, the staff examined the applicant's justifications, as documented in the audit summary report, 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 below presents the AMPs credited by the applicant and described in LRA Appendix B, "Aging Management Programs and Activities." The table also indicates (a) whether the AMP is an existing or new program, (b) the GALL Report AMP with which the applicant claimed consistency, (c) the SER section that documents the staff's evaluation of the program, and (d) the staff's final disposition of the AMP.

Table 3.0-1 WF3 Aging Management Programs

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Bolting Integrity	A.1.1 B.1.1	Existing	Consistent with Exception and Enhancements	XI.M18, "Bolting Integrity"	3.0.3.2.1 *(Consistent with Exception and Enhancements)*
Boric Acid Corrosion	A.1.2 B.1.2	Existing	Consistent	XI.M10, "Boric Acid Corrosion"	3.0.3.1.1 *(Consistent)*
Buried and Underground Piping and Tanks Inspection	A.1.3 B.1.3	New	Consistent	XI.M41, "Buried and Underground Piping and Tanks"	3.0.3.1.2 *(Consistent)*
Coating Integrity	A.1.4 B.1.4	New	Consistent with Exception	XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks"	3.0.3.2.2 *(Consistent with Exception)*
Compressed Air Monitoring	A.1.5 B.1.5	Existing	Consistent with Enhancements	XI.M24, "Compressed Air Monitoring"	3.0.3.2.3 *(Consistent with Enhancements)*
Containment Inservice Inspection – IWE	A.1.6 B.1.6	Existing	Consistent with Enhancement	XI.S1, "ASME Section XI, Subsection IWE"	3.0.3.2.4 *(Consistent with Enhancement)*
Containment Leak Rate	A.1.7 B.1.7	Existing	Consistent	XI.S4, "10 CFR Part 50, Appendix J"	3.0.3.1.3 *(Consistent)*
Diesel Fuel Monitoring	A.1.8 B.1.8	Existing	Consistent with Enhancements	XI.M30, "Fuel Oil Chemistry"	3.0.3.2.5 *(Consistent with Enhancements)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Environmental Qualification (EQ) of Electric Components	A.1.9 B.1.9	Existing	Consistent	X.E1, "Environmental Qualification (EQ) of Electric Components"	3.0.3.1.4 *(Consistent)*
External Surfaces Monitoring	A.1.10 B.1.10	Existing	Consistent with Enhancements	XI.M36, "External Surfaces Monitoring of Mechanical Components"	3.0.3.2.6 *(Consistent with Enhancements)*
Fatigue Monitoring	A.1.11 B.1.11	Existing	Consistent with Enhancements	X.M1, "Fatigue Monitoring"	3.0.3.2.7 *(Consistent with Enhancements)*
Fire Protection	A.1.12 B.1.12	Existing	Consistent with Enhancements	XI.M26, "Fire Protection"	3.0.3.2.8 *(Consistent with Enhancements)*
Fire Water System	A.1.13 B.1.13	Existing	Consistent with Exceptions and Enhancements	XI.M27, "Fire Water System"	3.0.3.2.9 *(Consistent with Enhancements and Exceptions)*
Flow-Accelerated Corrosion	A.1.14 B.1.14	Existing	Consistent with Enhancements	XI.M17, "Flow-Accelerated Corrosion"	3.0.3.2.10 *(Consistent with Enhancements)*
Inservice Inspection	A.1.15 B.1.15	Existing	Consistent with Enhancement	XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD"	3.0.3.1.5 *(Consistent with Enhancement)*
Inservice Inspection – IWF	A.1.16 B.1.16	Existing	Consistent with Enhancements	XI.S3, "ASME Section XI, Subsection IWF"	3.0.3.2.11 *(Consistent with Enhancements)*
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	A.1.17 B.1.17	Existing	Consistent with Enhancements	XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems"	3.0.3.2.12 *(Consistent with Enhancements)*
Internal Surfaces in Miscellaneous Piping and Ducting Components	A.1.18 B.1.18	New	Consistent	XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components"	3.0.3.1.6 *(Consistent)*
Masonry Wall	A.1.19 B.1.19	Existing	Consistent with Enhancements	XI.S5, "Masonry Walls"	3.0.3.2.13 *(Consistent with Enhancements)*
Metal Enclosed Bus Inspection	A.1.20 B.1.20	New	Consistent	XI.E4, "Metal Enclosed Bus"	3.0.3.1.7 *(Consistent)*
Neutron-Absorbing Material Monitoring	A.1.21 B.1.21	Existing	Consistent with Enhancement	XI.M40, "Monitoring of Neutron-Absorbing Materials Other than Boraflex"	3.0.3.2.14 *(Consistent with Enhancement)*
Nickel Alloy Inspection	A.1.22 B.1.22	Existing	Consistent	XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRS only)"	3.0.3.1.8 *(Consistent)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Non-EQ Electrical Cable Connections	A.1.23 B.1.23	New	Consistent	XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.9 *(Consistent)*
Non-EQ Inaccessible Power Cables (≥ 400 V)	A.1.24 B.1.24	New	Consistent with Exception	XI.E3, “Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.2.15 *(Consistent with Exception)*
Non-EQ Sensitive Instrumentation Circuits Test Review	A.1.25 B.1.25	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”	3.0.3.1.10 *(Consistent)*
Non-EQ Insulated Cables and Connections	A.1.26 B.1.26	New	Consistent	XI.E1, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements”	3.0.3.1.11 *(Consistent)*
Oil Analysis	A.1.27 B.1.27	Existing	Consistent	XI.M39, “Lubricating Oil Analysis”	3.0.3.1.12 *(Consistent)*
One-Time Inspection	A.1.28 B.1.28	New	Consistent	XI.M32, “One-Time Inspection”	3.0.3.1.13 *(Consistent)*
One-Time Inspection – Small-Bore Piping	A.1.29 B.1.29	New	Consistent	XI.M35, “One-Time Inspection of ASME Code Class 1 Small-Bore Piping”	3.0.3.1.14 *(Consistent)*
Periodic Surveillance and Preventive Maintenance	A.1.30 B.1.30	Existing	Plant-Specific	N/A	3.0.3.3.1 *(Plant-Specific)*
Protective Coating Monitoring and Maintenance	A.1.31 B.1.31	Existing	Consistent with Enhancement	XI.S8, “Protective Coating Monitoring and Maintenance Program”	3.0.3.2.16 *(Consistent with Enhancement)*
Reactor Head Closure Studs	A.1.32 B.1.32	Existing	Consistent with Enhancements	XI.M3, “Reactor Head Closure Stud Bolting”	3.0.3.2.17 *(Consistent with Enhancements)*
Reactor Vessel Internals	A.1.33 B.1.33	Existing	Consistent with Enhancement	XI.M16A, “PWR Vessel Internals”	3.0.3.2.18 *(Consistent with Enhancement)*
Reactor Vessel Surveillance	A.1.34 B.1.34	Existing	Consistent with Enhancement and Exception	XI.M31, “Reactor Vessel Surveillance”	3.0.3.1.15 *(Consistent with Enhancement and Exception)*
Selective Leaching	A.1.35 B.1.35	New	Consistent	XI.M33, “Selective Leaching”	3.0.3.1.16 *(Consistent)*
Service Water Integrity	A.1.36 B.1.36	Existing	Consistent with Enhancement	XI.M20, “Open-Cycle Cooling Water System”	3.0.3.2.19 *(Consistent with Enhancement)*

Applicant AMP	LRA Sections	New or Existing Program	LRA Initial Comparison to the GALL Report	GALL Report AMPs	SER Section (Disposition)
Steam Generator Integrity	A.1.37 B.1.37	Existing	Consistent with Enhancement	XI.M19, "Steam Generators"	3.0.3.1.17 *(Consistent with Enhancement)*
Structures Monitoring	A.1.38 B.1.38	Existing	Consistent with Enhancements	XI.S6, "Structures Monitoring"	3.0.3.2.20 *(Consistent with Enhancements)*
Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	A.1.39 B.1.39	New	Consistent	XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	3.0.3.1.18 *(Consistent)*
Water Chemistry Control – Closed Treated Water Systems	A.1.40 B.1.40	Existing	Consistent with Enhancements	XI.M21A, "Closed Treated Water Systems"	3.0.3.2.21 *(Consistent with Enhancements)*
Water Chemistry Control – Primary and Secondary	A.1.41 B.1.41	Existing	Consistent	XI.M2, "Water Chemistry"	3.0.3.1.19 *(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:

- Boric Acid Corrosion
- Buried and Underground Piping and Tanks Inspection
- Containment Leak Rate
- Environmental Qualification (EQ) of Electric Components
- Inservice Inspection
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Metal Enclosed Bus Inspection
- Nickel Alloy Inspection
- Non-EQ Electrical Cable Connections
- Non-EQ Sensitive Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections
- Oil Analysis
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Reactor Vessel Surveillance
- Selective Leaching
- Steam Generator Integrity
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry Control – Primary and Secondary

3.0.3.1.1 Boric Acid Corrosion

Summary of Technical Information in the Application. LRA Section B.1.2 describes the existing Boric Acid Corrosion program as consistent with GALL Report AMP XI.M10, "Boric Acid Corrosion." The LRA states that the AMP addresses mechanical, electrical, and structural

components for loss of material and increase in connection resistance for components on which borated water may leak. The LRA also states that the program includes visual inspections of external surfaces, leak path identification, boric acid residue removal, degradation assessment, and followup inspections.

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.M10. 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.M10.

Operating Experience. LRA Section B.1.2 summarizes operating experience related to the Boric Acid Corrosion program. The LRA describes an instance in which the applicant identified a boric acid leak at the body-to-bonnet connection on a pressurizer spray control valve and took corrective action to clean the borated water residue, repack the valve, and replace the bonnet gasket. The applicant subsequently inspected the valve and confirmed that the condition was corrected. The LRA also describes instances in which inspections identified boric acid residue on a containment spray header vent valve and a high-pressure safety injection pump casing. Investigations confirmed that there were no associated active leaks and there was no impact on the pressure boundary or pump operability.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicant reviewed the applicable aging effects and industry and plant-specific operating experience. 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.M10 was evaluated.

FSAR Supplement. LRA Section A.1.2 provides the FSAR supplement for the Boric Acid Corrosion program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Boric Acid Corrosion 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Buried and Underground Piping and Tanks Inspection

Summary of Technical Information in the Application. LRA Section B.1.3 describes the new Buried and Underground Piping and Tanks Inspection program as consistent with GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," as modified by LR-ISG-2011-03, "Changes to the GALL Report Revision 2 Aging Management Program XI.M41, 'Buried and Underground Piping and Tanks.'" The LRA states that the AMP addresses carbon steel, gray cast iron, and concrete piping exposed to buried environments to manage the effects of loss of material and cracking. The LRA also states that the AMP proposes to manage these aging effects through opportunistic and directed excavations (i.e., direct visual inspections) and preventive actions including coatings, backfill quality, and cathodic protection.

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 7 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M41, as modified by LR-ISG-2011-03.

For the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

During its audit, the staff noted that the applicant's Buried and Underground Piping and Tanks Inspection program and the associated FSAR Summary Description had not been evaluated against the changes to AMP XI.M41 and the FSAR Summary Description issued in LR-ISG-2015-01, "Changes to Buried and Underground Piping and Tank Recommendations," which replaced AMP XI.M41, issued in LR-ISG-2011-03. By letter dated September 15, 2016, the staff issued RAI B.1.3-1 requesting that the applicant state and justify exception(s) to the recommendations in LR-ISG-2015-01 that will not be incorporated into the Buried and Underground Piping and Tanks Inspection program.

In its response dated October 13, 2016, the applicant stated that the Buried and Underground Piping and Tanks Inspection program takes no exceptions to the program described in LR-ISG-2015-01 and revised LRA Sections A.1.3, B.1.3, and 2.1.3 to incorporate the recommendations of LR-ISG-2015-01. The staff noted that the revised LRA Sections A.1.3 and B.1.3 stated that the external surfaces of buried piping components subject to an AMR will be managed for loss of material and cracking; however, AMP XI.M41 states that the program addresses aging effects of loss of material, cracking, and changes in material properties (for cementitious piping only). In addition, the staff noted that concrete (i.e., cementitious) piping is included within the scope of the program. By letter dated November 15, 2016, the staff issued RAI B.1.3-1a requesting that the applicant state the basis for why change in material properties is not an applicable aging effect for concrete piping.

In its response dated December 15, 2016, the applicant stated that while change in material properties is not considered an AERM, visual inspections to manage cracking and loss of material would be expected to identify aging effects, if any, resulting from a change in material properties.

The staff finds the applicant's response acceptable because changes in material properties for cementitious piping can be evidenced by visual indications of cracking (e.g., cracking due to

chemical reaction, weathering, or settling) and loss of material (e.g., delamination, exfoliation, spalling, popout, or scaling). The staff's concern described in RAI B.1.3-1 is resolved.

Based on its audit and review of the applicant's responses to RAI B.1.3-1 and RAI B.1.3-1a, the staff finds that program elements 1 through 7 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.

Operating Experience. LRA Section B.1.3 summarizes operating experience related to the Buried and Underground Piping and Tanks Inspection program. The applicant stated that operating experience includes a reduction in cathodic protection system availability from 2009 to 2014 due to failures of a buried power cable that provided DC current from the rectifier to the anode bed. A modification was completed in 2014 to move the rectifier closer to the anode bed to reduce the frequency of breaks in the power supply cable, resulting in improved availability of the cathodic protection system. The applicant also stated that in 2013, a crack in the concrete encasement around the condensate dump piping was identified. An engineering inspection concluded that there was no evidence of leakage or corrosion, and the crack was sealed before backfilling the excavation.

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.M41 was evaluated.

FSAR Supplement. LRA Section A.1.3, as amended by letter dated October 13, 2016, provides the FSAR supplement for the Buried and Underground Piping and Tanks Inspection program. The staff reviewed this FSAR 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 new Buried and Underground Piping and Tanks Inspection program prior to the period of extended operation for managing the effects of aging for applicable components (commitment no. 2 as listed in SER Appendix A).

The staff finds that the information in the FSAR supplement, as amended by letter dated October 13, 2016, is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Buried and Underground Piping and Tanks 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Containment Leak Rate

Summary of Technical Information in the Application. LRA Section B.1.7 describes the existing Containment Leak Rate program as consistent with GALL Report AMP XI.S4, "10 CFR Part 50, Appendix J." The applicant amended this LRA section by letter dated November 15, 2017, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17319A421). The amended program description states that the program consists of tests performed in accordance with regulations and guidance provided in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B; NEI 94-01, Revision 2-A, "Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J;" and ANSI/ANS 56.8, "Containment System Leakage Testing Requirements." The applicant also stated that the program performs Type A or integrated leakage rate tests (ILRTs) at the peak loss-of-coolant accident (LOCA) containment pressure. The applicant further stated that a general visual examination of the accessible interior and exterior areas of the steel containment vessel is performed prior to an ILRT and during two subsequent refueling outages before the next ILRT. Satisfactory performance of the ILRT, and Type B and Type C local leakage rate tests (LLRTs) at frequencies specified in the implementing document for 10 CFR Part 50, Appendix J, Option B, demonstrate the leak-tightness and structural integrity of the containment and containment pressure-containing or leakage-limiting boundary components and isolation barriers.

The applicant stated the program monitors leakage rates of the steel containment vessel and associated welds, penetrations, fittings, and other access openings due to loss of leakage tightness, loss of material, loss of sealing, loss of preload, or cracking. Gaskets, O-rings, and packing materials are monitored for age-related degradation. The applicant also stated while satisfactory performance of leakage rate tests (LRTs) demonstrates the leak-tightness and structural integrity of the containment, it does not provide information that would indicate that aging degradation has initiated or that the capacity of the containment may have been reduced. However, this is achieved with implementation of a containment inservice inspection (ISI) program as described in ASME Code Section XI, Subsection IWE. The applicant further stated the program documents and trends test results and sets acceptance criteria in accordance with 10 CFR Part 50, Appendix J, Option B. Evaluations are performed for test or inspection results that do not satisfy established criteria. Condition Reports (CRs) are initiated to document relevant issues in accordance with plant administrative procedures. Corrective actions are taken in accordance with applicable procedures that meet the requirements of 10 CFR Part 50, Appendix B.

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. 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.S4 (which satisfies the 10 CFR Part 50 Appendix J rule) recommends inclusion of all the containment boundary pressure-retaining components in the program. However, during its audit, the staff found that

the WF3 containment leakage rate testing (Appendix J) procedures exclude from LLRTs a certain number of pressure-retaining boundary components and isolation barriers (e.g., valves, penetrations). It was not clear how the LRA AMP B.1.7, "Containment Leak Rate," satisfies the described bounding condition of inclusion in the "scope of program" program element for consistency with the GALL Report AMP XI.S4. By letter dated September 15, 2016, the staff issued RAI B.1.7-1, requesting that the applicant identify how the effects of aging for the containment boundary pressure-retaining components excluded from the "scope of program" program element will be managed during the period of extended operation, and indicate the AMPs, TLAAs, and/or AMR items that address the issue.

In its response dated October 13, 2016, the applicant summarized the AMR results crediting LRA AMPs in the LRA Table 2s to manage the effects of aging for the exempted/excluded carbon steel and stainless steel containment boundary pressure-retaining components. The applicant stated that applicable aging effects are to be managed, as follows:

(1) For all external surfaces, through LRA AMP B.1.10, "External Surfaces Monitoring." For:

   (a) Penetrations 1, 2, 4, and 5, where the material is carbon steel exposed to steam, through LRA AMP B.1.14, "Flow-Accelerated Corrosion," and/or LRA AMP B.1.41, "Water Chemistry Control – Primary and Secondary"

   (b) Penetrations 3, 4, 15-22, where the material is carbon steel exposed to treated water, through LRA AMP B.1.41, "Water Chemistry Control – Primary and Secondary," and/or LRA AMP B.1.40, "Water Chemistry Control – Closed Treated Water Systems"

   (c) Penetrations 32-33, 34 A&B-35 A&B, where the material is stainless steel exposed to treated borated water, through LRA AMP B.1.40, "Water Chemistry Control – Primary and Secondary"

   (d) Penetrations 27, 36-39, 55-59, and 69-70, where the material is stainless steel and/or cast austenitic stainless steel (CASS) exposed to treated borated water, including material exposed to temperature >140 °F, through LRA AMP B.1.15, "Inservice Inspection," and/or LRA AMP B.1.41, "Water Chemistry Control – Primary and Secondary"

   (e) Penetration 68, where the material is stainless steel exposed to steam, through LRA AMP B.1.41, "Water Chemistry Control – Primary and Secondary"

For Penetration 54, the applicant stated there are no credible aging effects associated with the internal surface of a sealed stainless steel oil filled capillary tubing not subject to 10 CFR Part 50, Appendix J testing, because the sealed hydraulic oil is not exposed to water contamination and there are no other applicable aging mechanisms that could result in aging effects.

The staff finds the response to RAI B.1.7-1 acceptable because the applicant provided the AMR results in the LRA indicative of materials, environments, and LRA AMPs that are to be used to monitor and manage the safety function of leak tightness for the exempted/excluded containment boundary pressure-retaining components during the period of extended operation.

The staff evaluation of AMR results of containment boundary pressure-retaining components exempted/excluded from the "scope of program," program element of the Containment Leak Rate program are documented in the appropriate SER sections based on their listings in Table 2 system sections (i.e., LRA Tables 3.1.2-3, 3.2.2-1, 3.2.2-2, 3.3.2-1, 3.3.2-3, 3.4.2-2,

3.4.2-3, 3.4.2-4) and associated Table 1 references. The staff's concern described in RAI B.1.7-1 is resolved.

Based on its audit, and review of the applicant's response to RAI B.1.7-1, 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.S4.

Operating Experience. LRA Section B.1.7 summarizes operating experience related to the Containment Leak Rate AMP. The operating experience described in the LRA indicates proper implementation of ILRTs, LLRTs, IWE ISIs, and corrective actions prior to loss of intended function, which collectively provide reasonable assurance that aging effects are managed, and leak-tightness and structural integrity of the primary containment are maintained and will continue to be maintained during the period of extended operation.

To this end, the LRA presents five examples of failed LLRTs; however, the encountered age-related degraded conditions did not result in loss of the containment function. For example, while performing an LLRT on a feedwater isolation valve in 2014 the air accumulator pressure drop test failed due a check valve not seating. A condition report (CR) was initiated and a work order was issued to replace the valve. Following replacement of the valve, the subsequent LLRT accumulator pressure drop test was successfully completed. An additional example presented considers a 2014 LLRT performed on a main steam line penetration. The LLRT measured leakage exceeded the administrative limit. Through visual inspections, potential pathways of six degraded welds around the perimeter of the primary guard pipe bellows contributing to excessive leakage were identified. A CR was initiated and corrective actions were scheduled and completed in accordance with the work management process. This condition did not represent a loss of containment intended function, as the total containment leakage was below the maximum allowable overall leakage rate.

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's 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, and review of the applicant's response to RAI B.1.7-1, 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.

FSAR Supplement. LRA Section A.1.7 provides the FSAR supplement for the Containment Leak Rate AMP. By letter dated November 15, 2017, the applicant amended the FSAR supplement (ADAMS Accession No. ML17319A421). The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Containment Leak Rate program and response to RAI B.1.7-1, dated October 13, 2016, the staff concludes that the program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Environmental Qualification (EQ) of Electric Components

Summary of Technical Information in the Application. LRA Section B.1.9 describes the existing Electrical Qualification (EQ) of Electric Components program as consistent with GALL Report AMP X.E1, "Environmental Qualification of (EQ) of Electric Components." The LRA states that the AMP addresses Environmental Qualification (EQ) of Electric Components and manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The LRA also states that station EQ requirements are established by 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49, which specifically require that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (i.e., those areas of the plant that could be subject to the harsh environmental effects of a LOCA, high-energy line breaks, or high radiation) are qualified to perform their safety function in these harsh environments. The LRA further states that 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification. Components are refurbished, replaced, or their qualification is extended before reaching the aging limits established in the evaluation. The applicant concluded in the LRA that the Environmental Qualification (EQ) of Electric Components program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the CLB through the period of extended operation. The LRA identified that some aging evaluations for EQ components are time-limited aging analyses (TLAAs) for 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 X.E1, "Environmental Qualification (EQ) of Electric Components."

As referenced in SRP-LR Section 4.4.2.1.3, "10 CFR 54.21(c)(1)(iii)," and GALL Report Chapter X, "Time-Limited Aging Analysis Evaluation of Aging Management Programs Under 10 CFR 54.21(c)(1)(iii)," the staff evaluated 10 CFR 50.49 and determined that plant EQ programs, which implement the requirements of 10 CFR 50.49, are viewed as an acceptable AMP to address EQ of components in accordance with 10 CFR 54.21(c)(1)(iii). Consistent with the GALL Report AMP X.E1, the applicant's program addresses EQ reanalysis and the associated component reanalysis attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions.

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.1.9 summarizes operating experience related to the Environmental Qualification (EQ) of Electric Components program. The LRA identified plant operating experience examples as summarized below.

The applicant referenced a focused self-assessment performed in 2011. The evaluation covered the overall health of the applicant's EQ program and its conformance to 10 CFR 50.49. The self-assessment recommended that additional personnel be qualified to maintain EQ files. Subsequent to the recommendation, a backup program owner was fully qualified. The self-assessment also found that three changes to EQ preventive maintenance tasks resulted in incorrect replacement dates. Further review by the assessment team determined that this was an isolated case. A CR search by the applicant did not identify any additional EQ program aging management issues.

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 results of the staff's independent search of the applicant's operating experience were bounded by known industry operating experience and consistent with the applicant's plant-specific operating experience evaluated for the EQ program.

Operating experience reviewed by the staff included a review of EQ equipment health reports issued for 2010, 2011, 2012, and 2013. More recent health reports were not generated by the applicant because of programmatic changes that revised the assessment interval. All reports reviewed indicated a program rating of "green." A review of work orders, EQ files, and corrective actions did not find any significant or unusual operating experience and no previously unknown or recurring aging effects were identified by the applicant or staff. 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 X.E1 was evaluated.

FSAR Supplement. LRA Section A.1.9 provides the FSAR supplement for the Environmental Qualification (EQ) of Electric Components program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Environmental Qualification (EQ) 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Inservice Inspection

Summary of Technical Information in the Application. LRA Section B.1.15 describes the existing Inservice Inspection program as consistent with GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD." The LRA states that the AMP manages cracking, loss of material, and reduction in fracture toughness for ASME Class 1, 2, and 3 pressure-retaining components using periodic volumetric, surface, and visual examination and leakage testing as specified in ASME Section XI code, 2001 Edition, 2003 addendum. In addition, the LRA states that every 10 years this program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a.

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.

The staff noted that some of the inspection activities that would normally be implemented in accordance with the applicant's Nickel Alloy Inspection program (LRA Section B.1.22) will be implemented instead by the applicant's Inservice Inspection program. The staff's evaluation of the Nickel Alloy Inspection program is documented in SER Section 3.0.3.1.8. Based on the staff's audit of the Nickel Alloy Inspection program, the staff determined that program elements 1 through 6 of the program, when coupled to the corresponding program elements of the Inservice Inspection program (LRA Section B.1.15) and Boric Acid Corrosion program (LRA Section B.1.2), for which the applicant claimed consistency with the GALL Report, are consistent with the corresponding program elements of GALL Report AMP XI.M11B.

Specifically, the staff noted that although the scope of the Nickel Alloy Inspection program is limited to nickel alloy component locations in the RCS cold leg loops, the applicant implements augmented inspection activities for the other nickel alloy components within the reactor coolant pressure boundary (RCPB) (i.e., the nickel alloy penetration nozzles and welds in the upper reactor vessel (RV) closure head and those nickel alloy base metal components or weld components in the RCS hot leg, pressurizer, or steam generators (SGs) that have been repaired or mitigated with Alloy 690 base metal materials or Alloy 52, 152, or 52/152 weld metal materials) using the applicant's Inservice Inspection program (LRA Section A.1.15). The staff also confirmed that the applicant implements visual inspections for evidence of borated water leakage or boric acid residues that may induce loss of material in ferritic RCPB components using the applicant's Boric Acid Corrosion program (LRA AMP B.1.2). The staff noted that these additional inspection activities are consistent with those defined in GALL Report AMP XI.M11B. Therefore, the staff confirmed that when the inspections for nickel alloy components in the RCS cold leg loops are coordinated with those for the remaining nickel alloy components in the RCPB using the Inservice Inspection program and the augmented inspection activities of the Boric Acid Corrosion program, the condition monitoring bases for nickel alloy components in the RCPB are consistent with those defined in the program elements of GALL Report AMP XI.M11B.

Enhancement. By letter dated December 7, 2016, the applicant provided an enhancement to the Inservice Inspection program in response to RAI 3.1.2.2.6-1 related to inspection of its CASS Class 1 piping components. The staff finds the enhancement acceptable because the program, once enhanced, will include an ASME or EPRI qualified inspection technique, which

will adequately detect cracks, prior to entering the period of extended operation. The staff's review and discussion of the enhancement is documented in SER Section 3.1.2.2.6, item 2.

Operating Experience. LRA Section B.1.15 summarizes operating experience related to the Inservice Inspection program. The LRA describes its outage inspection performed in 2008. Based on the examinations, there were no relevant conditions requiring evaluation for continued service.

The Operating Experience section also states: "In January 2010, surface examination for the nozzle-to-top head dome weld was not completed in the second ISI program Interval as required by ASME Section XI." During the onsite audit, the staff performed a plant-specific operating experience review and noted that, in addition to missing an item in 2010, the applicant had also missed a Code-required examination in 2012. The missed item, related to Line 2RC3/4-56, was documented in NRC Integrated Inspection Report 05000382/2012005.

The staff noted that the applicant missed a Code-required examination item in consecutive outage inspections. It was not clear to the staff that the program would be effective in managing aging during the period of extended operation if Code-required examinations are routinely missed. By letter dated October 12, 2016, the staff issued RAI B.1.15-1, requesting that the applicant provide and describe the programmatic controls in place to ensure that the scope of the ISI IWB, IWC, and IWD inspections are implemented in accordance with requirements of 10 CFR 50.55a.

In its response, by letter dated November 10, 2016, the applicant stated that the missed items were results of errors in its Inservice Inspection database. The database has since been corrected. The applicant also stated that one of the missed items was evaluated and was determined to not be needed based on correction of a test procedure, and the other missed item was made up by a subsequent examination. The staff reviewed the applicant's response and noted that the applicant identified the causal factors of the missed items and corrected the errors. In addition, the required examinations were performed during the subsequent outage inspection. Therefore, the staff finds the program acceptable. The staff's concern in RAI B.1.15-1 is resolved.

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's review of operating experience associated with nickel alloy based metal and weld component locations in the RCPB was performed as part of the operating experience review for the applicant's Nickel Alloy Inspection program (LRA Section B.1.22), as documented in SER Section 3.0.3.1.8. The staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

Based on its audit, review of the application and the RAI response, 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.M1 was evaluated.

FSAR Supplement. LRA Section A.1.15 provides the FSAR supplement for the Inservice Inspection program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Inservice 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Internal Surfaces in Miscellaneous Piping and Ducting Components

Summary of Technical Information in the Application. LRA Section B.1.18 describes the new Internal Surfaces in Miscellaneous Piping and Ducting Components program as 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 AMP will manage fouling, cracking, loss of material, and changes in material properties of the internal surfaces of metallic and non-metallic piping and components exposed to indoor air, outdoor air, condensation, diesel exhaust, raw water, and waste water. The LRA also states that the AMP proposes to detect these aging effects through visual inspections, physical manipulation, and pressurization.

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.

In reviewing the program for consistency with the GALL Report, the staff notes that the applicant's program includes fouling as an AERM, and that management of fouling is not included as an AERM in GALL Report AMP XI.M38. The program proposes to manage reduction of heat transfer of aluminum, copper alloy, and copper alloy with greater than 15 percent zinc (inhibited) heat exchanger fins and tubes exposed to indoor air and condensation by using periodic visual inspections. As discussed in SER Section 3.3.2.3.5, for aluminum, copper alloy, and copper alloy with greater than 15 percent zinc (inhibited) heat exchanger fins and tubes exposed to indoor air and condensation, the staff finds that the visual inspections conducted by the program, with a representative sample of components inspected at least once every 10 years, are capable of detecting fouling of the heat exchanger surfaces prior to loss of the intended function.

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. In addition, the staff reviewed the additional aging effect being managed by this program and finds that the associated effects of aging will be adequately managed.

Operating Experience. LRA Section B.1.18 summarizes operating experience related to the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The LRA states that the new program is based on GALL Report AMP XI.M38, which industry operating experience has demonstrated to be adequate to manage the applicable aging effects.

The staff reviewed operating experience information 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 was evaluated.

FSAR Supplement. LRA Section A.1.18 provides the FSAR supplement for the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff reviewed this FSAR 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 Internal Surfaces in Miscellaneous Piping and Ducting Components program prior to the period of extended operation for managing the effects of aging for applicable components (commitment no. 14 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's 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). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Metal Enclosed Bus Inspection

Summary of Technical Information in the Application. LRA Section B.1.20 describes the new Metal Enclosed Bus Inspection program as consistent with GALL Report AMP XI.E4, "Metal Enclosed Bus." The LRA states that the AMP addresses the inspection of the internal and external portions of metal-enclosed bus (MEB) to identify age-related degradation of the bus and bus connections, the bus enclosure assemblies, and the bus insulation and insulators as well as elastomer material (e.g., gaskets, boots, sealants). The program will inspect the safety-related 4.16 kV MEBs (non-segregated) between switchgear 3A3-S and 3AB3-S and 3B3-S, and the safety-related 480 V MEBs (non-segregated) between 3A31-S and 3AB31-S and 3B31-S. The LRA also states that the program manages aging by inspecting the following components and aging effects:

- buses and connections for signs of loss of material and increased connection resistance
- enclosure assemblies for loss of material due to general pitting and crevice corrosion
- elastomers for change in material properties (surface cracking, crazing, scuffing, dimensional change, shrinkage, discoloration, hardening, and loss of strength)
- bus insulators for signs of reduced insulation resistance (as indicated by embrittlement, cracking, chipping, melting, discoloration, swelling or surface contamination)
- internal bus supports/insulators for structural integrity and signs of cracks

The LRA also states that the AMP proposes to manage these aging effects through visual inspections, thermography (when possible), and resistance measurements (quantitative).

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 finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.20 summarizes operating experience related to the Metal Enclosed Bus Inspection program. A search of the site-specific operating experience did not reveal any issues with non-segregated buses. The program considers the technical information and industry operating experience provided in SAND 96-0344, IEEE Std. 1205-2000, NRC IN 89-64, NRC IN 98-36, NRC IN 2000-14, and NRC IN 2007-01.

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 search found that the operating experience provided by the applicant is bounded by known industry operating experience. The review of a sample of work orders did not find any significant or unusual operating experience and no previously unknown or recurring aging effects were identified by the applicant or staff. 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.E4 was evaluated.

FSAR Supplement. LRA Section A.1.20 provides the FSAR supplement for the Metal Enclosed Bus Inspection program. The staff reviewed this FSAR 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 Metal Enclosed Bus Inspection program prior to June 18, 2024, for managing the effects of aging for applicable components (commitment no. 16 as listed in Appendix A).

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Metal Enclosed Bus 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Nickel Alloy Inspection

Summary of Technical Information in the Application. LRA Section B.1.22 describes the existing Nickel Alloy Inspection program as consistent with GALL Report AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWR only)." The technical information the applicant stated in the LRA is summarized as follows.

The program is used to manage: (a) cracking due to primary water stress corrosion cracking (PWSCC) in nickel-alloy components made from Alloy 600 base metal material or Alloy 82 or 182 weld material, and (b) loss of material due to boric acid-induced corrosion in susceptible safety-related components in the vicinity of nickel-alloy components located in the RCPB. The program is consistent with program element criteria in GALL Report AMP XI.M11B without exception or the need for enhancement of program elements.

The program uses nondestructive examination (NDE) techniques, radiation monitoring, and visual inspections for boric acid deposits or the presence of moisture to identify cracking in the RCPB or loss of material. The inspection methods, schedules, and frequencies are implemented in accordance with 10 CFR 50.55a. Reactor coolant leakage is calculated and trended on a routine basis in accordance with technical specifications (TS). The methodology for evaluating flaws and acceptance criteria for identified flaws are prescribed in 10 CFR 50.55a and unacceptable indications of flaws are corrected through implementation of appropriate repair or replacement, as dictated in 10 CFR 50.55a.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The results of the audit review are documented in the Audit Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M11B.

Based on its audit, the staff finds that program elements 1 through 6, when coupled with the corresponding program elements of the Inservice Inspection program (LRA Section B.1.15) and Boric Acid Corrosion program (LRA Section B.1.2), for which the applicant claimed consistency with the GALL Report, are consistent with the corresponding program elements of GALL Report AMP XI.M11B. Specifically, the staff noted that although the scope of the Nickel Alloy Inspection program is limited to nickel alloy component locations in the RCS cold leg loops, the applicant implements augmented inspection activities for the other nickel alloy components in the RCPB (i.e., the nickel alloy penetration nozzles and welds in the upper reactor vessel closure head and those nickel alloy base metal components or weld components in the RCS hot leg, pressurizer, or SGs that have been repaired or mitigated with Alloy 690 base metal materials or Alloy 52, 152, or 52/152 weld metal materials) using the applicant's Inservice Inspection program (LRA Section A.1.15). The staff also confirmed that the applicant implements visual inspections for evidence of borated water leakage or boric acid residues that

may induce loss of material in ferritic RCPB components using the applicant's Boric Acid Corrosion program (LRA AMP B.1.2). The staff noted that these additional inspection activities are consistent with those defined in GALL Report AMP XI.M11B. Therefore, the staff confirmed that, when the inspections for nickel alloy components in the RCS cold leg loops are coordinated with those for the remaining nickel alloy components in the RCPB using the Inservice Inspection program and the augmented inspection activities of the Boric Acid Corrosion program, the condition monitoring bases for nickel alloy components in the RCPB are consistent with those defined in the program elements of GALL Report AMP XI.M11B.

Operating Experience. LRA Section B.1.22 summarizes operating experience related to the Nickel Alloy Inspection program. The applicant stated that, in October 2000, a small amount of boric acid was discovered in the area around an Inconel Alloy 600 pressurizer heater sleeve during a bare metal inspection. The applicant also stated that corrective actions were taken by plugging the heater sleeve, inspecting all other pressurizer heater sleeves, and updating the Nickel Alloy Inspection program plan to address repair and replacement of heater sleeves.

In addition, the applicant stated that, in April 2005, a small amount of boric acid was discovered in the annulus around two pressurizer heater sleeves during a bare metal inspection. The applicant stated that the boric acid residue provided evidence that PWSCC had occurred in the Alloy 600 heater sleeve. The applicant also stated that it repaired the impacted heater sleeve nozzles and all of the remaining pressurizer heater nozzles needing repair.

The staff reviewed operating experience information in the LRA 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 also reviewed the CR database to identify additional operating experience with PWSCC that may have occurred in nickel alloy locations in the RCPB.

The staff determined that the applicant has had operating experience with reactor coolant leakage in a number of nickel alloy components in the RCPB, including penetration nozzles welded to the reactor vessel closure head, pressurizer heat sleeves, and nickel alloy instrumentation nozzles in the RCS hot leg loops and pressurizer. The staff reviewed several CRs issued relative to these operating experience events.

The staff observed that, in general, the applicant has been appropriately implementing its inspections of nickel alloy component locations in the RCPB in accordance with the augmented inspection requirements and applicable ASME Code Case criteria that are required to be implemented for these components in accordance with 10 CFR 50.55a. The staff also observed that the applicant has been using its CR process and corrective action program to correct and repair or mitigate any occurrence of RCPB leakage at the plant. Thus, the staff did not identify any operating experience that would indicate that the applicant should consider modifying its proposed program.

FSAR Supplement. LRA Section A.1.22 provides the FSAR supplement for the Nickel Alloy Inspection program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff noted that the FSAR supplement for this AMP summarized augmented inspection activities of nickel alloy components in the RCPB that are made from Alloy 600 base metal

materials or Alloy 82, 182, or 82/182 weld materials, and therefore limited to the nickel alloy base metal or weld components in the RCS cold leg loops. However, the staff verified that the summary of the additional inspection activities for nickel alloy penetration nozzles in the upper reactor vessel closure head or nickel alloy base metal or weld components in the RCS hot leg, SG, or pressurizer systems are sufficiently addressed in the scope of the FSAR supplement for the applicant's Inservice Inspection program (LRA Section A.1.15). The staff noted that the applicant implements visual inspections for evidence of boric acid corrosion that may induce loss of material in ferritic components of the RCPB using the applicant's Boric Acid Corrosion program (LRA AMP B.1.2) and confirmed that the applicant provides a sufficient summary of these inspections in the FSAR supplement summary description for the Boric Acid Corrosion program (LRA Section A.1.2).

The staff finds that when the information in LRA Section A.1.22 is taken into account with the FSAR supplement summary descriptions of the Inservice Inspection program and Boric Acid Corrosion program, the collective set of FSAR supplement information provides an adequate summary of the augmented inspections that will be applied to nickel alloy component locations in the RCPB and the inspections for borated water leakage that will be applied to ferritic components in the RCPB that are in the vicinity of these nickel alloy component locations.

Conclusion. Based on its audit and review of the applicant's Nickel Alloy Inspection program, the staff concludes that, when the program elements for the AMP are evaluated in combination with those for the Inservice Inspection program and Boric Acid Corrosion programs program in the LRA, the program elements for which the applicant claimed consistency with the GALL Report are consistent with those in GALL Report AMP XI.M11B. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Non-EQ Electrical Cable Connections

Summary of Technical Information in the Application. LRA Section B.1.23 describes the new Non-EQ Electrical Cable Connections 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 new one-time inspection AMP provides reasonable assurance that the intended functions of the metallic parts of electrical cable connections are maintained consistent with the CLB through the period of extended operation. Cable connections included are those connections in the scope of license renewal susceptible to age-related degradation resulting in increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, or oxidation, and that are not subject to the EQ requirements of 10 CFR 50.49. The LRA also states that a representative sample of in-scope connections will be inspected. Inspection methods may include thermography, contact resistance testing, or other appropriate testing methods without removing the connection insulation, such as heat shrink tape, sleeving, or insulating boots.

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.1.23 summarizes operating experience related to the Non-EQ Electrical Cable Connections program. A search of the site-specific operating experience did not reveal any issues with in-scope non-EQ electrical cable connections. The program considers the technical information and industry operating experience provided in publications including: SAND 96-0344, IEEE Std. 1205-2000, Final License Renewal Interim Staff Guidance (LR-ISG)-2007-02, and the staff's response to the NEI white paper on AMP XI.E6.

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 search found that the operating experience provided by the applicant is bounded by known industry operating experience. The review of a sample of work orders and CRs did not find any significant or unusual operating experience and no previously unknown or recurring aging effects were identified by the applicant or staff. 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.

FSAR Supplement. LRA Section A.1.23 provides the FSAR supplement for the Non-EQ Electrical Cable Connections program. The staff reviewed this FSAR 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 Non-EQ Electrical Cable Connections program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later, for managing the effects of aging for applicable components (commitment no. 18 as listed in Appendix A).

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Non-EQ Electrical Cable Connections 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Non-EQ Sensitive Instrumentation Circuits Test Review

Summary of Technical Information in the Application. LRA Section B.1.25 describes the new, Non-EQ Sensitive Instrumentation Circuits Test Review 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 AMP addresses insulation material for electrical cables and connections used in instrumentation circuits exposed to heat, moisture, and radiation to manage the effects of reduced insulation resistance. The LRA also states that the AMP proposes to manage these aging effects through the review of calibration results or findings of surveillance testing programs performed once every 10 years, with the first review occurring before the period of extended operation. For sensitive instrumentation circuit cables that are disconnected during instrument calibrations, testing using a proven method for detecting deterioration of the insulation system (such as insulation resistance tests or time domain reflectometry) will occur at least once every 10 years, with the first review occurring 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.E2, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits.”

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.1.25 summarizes operating experience related to the Non-EQ Sensitive Instrumentation Circuits Test Review program. A search of site-specific operating experience did not reveal any failures with instrumentation cables and connections that perform a license renewal intended function. The AMP considers industry operating experience as identified in element 10 to GALL Report AMP XI.E2.

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.

FSAR Supplement. LRA Section A.1.25 provides the FSAR supplement for the Non-EQ Sensitive Instrumentation Circuits Test Review program. The staff reviewed this FSAR 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 Non-EQ Sensitive Instrumentation Circuits Test Review program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024 (whichever is later), for managing the effects of aging for applicable components (commitment no. 20 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Non-EQ Sensitive Instrumentation Circuits Test Review 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 Non-EQ Insulated Cables and Connections

Summary of Technical Information in the Application. LRA Section B.1.26 describes the new "Non-EQ Insulated Cables and Connection" program, as consistent with GALL Report AMP XI.E3, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The LRA states that the "Non-EQ Insulated Cables and Connections" program is a new condition monitoring program that provides reasonable assurance that the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation, and moisture can be maintained consistent with the CLB through the period of extended operation. The applicant's program is stated to visually inspect all accessible cable and connection insulation material located in adverse localized environments for surface anomalies, including cracking, melting, or surface contamination indicating signs of reduced insulation resistance. The LRA concludes that the program sample of accessible insulated cables and connections will represent, with reasonable assurance, all insulated cables and connections in the adverse localized environment. The visual inspection of accessible insulated cables and connections is to be performed at least once every 10 years with the first inspection prior to the period of extended operation. The applicant's search of plant-specific operating experience found no aging mechanisms not considered in the GALL Report. The "Non-EQ Insulated Cables and Connections" program is stated to include consideration of industry operating experience when implementing the program and that plant operating experience gained during program implementation will be factored into the program through the applicant's 10 CFR Part 50 Appendix B quality assurance 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.E1. For the "parameters monitored or inspected" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "parameters monitored or inspected" program element in GALL Report AMP XI.E1 recommends that accessible electrical cables and connections installed in adverse localized environments are to be visually inspected for cable jacket and connection insulation surface anomalies. However, during its audit, the staff found that the applicant's bases document WF3-EP-14-00009, "Aging Program Evaluation Results" – Electrical, Section 3.5.B.3.b, "Comparison to WF3 Parameters Monitored or Inspected" stated that for "parameters monitored or inspected," only a representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket and insulation surface anomalies. By letter dated October 12, 2016, the staff issued RAI B.1.26-1 requesting that the applicant clarify the WF3-EP-14-00009, "Aging Program Evaluation Results" – Electrical, Section 3.5.B.3.b, "Comparison to WF3 Parameters Monitored

or Inspected" program representative sample approach, as compared with the GALL Report AMP XI.E1 recommendation and LRA AMP B.1.26 statement that all accessible electrical cables and connections installed in adverse localized environments are visually inspected for cable jacket and connection insulation surface anomalies.

In its response dated November 10, 2016, the applicant noted that LRA Section B.1.26 states: "Accessible insulated cables and connections within the scope of license renewal installed in an adverse localized environment will be visually inspected for cable and connection jacket surface anomalies, such as embrittlement, discoloration, cracking, melting, swelling, or surface contamination, indicating signs of reduced insulation resistance. The program sample consists of all accessible cables and connections in localized adverse environments. This program sample of accessible cables will represent, with reasonable assurance, all cables and connections in the adverse localized environment." The applicant explained that commitment no. 21 is to implement the program as described in LRA Section B.1.26 and WF3-EP-14-00009, "Aging Program Evaluation Results" – Electrical Section 3.5.B.3.b is to be revised to clarify the intent is consistent with the LRA B.1.26 program description.

The staff finds the applicant's response acceptable because bases document WF3-EP-14-00009, "Aging Program Evaluation Results" will be revised consistent with LRA Section B.1.26 and GALL Report AMP XI.E1 program element, "parameters monitored or inspected" such that in-scope accessible insulated cables and connections installed in an adverse localized environment are visually inspected for cable and connection jacket surface anomalies. The staff's concern described in RAI B.1.26 is resolved.

Based on its audit, and review of the applicant's response to RAI B.1.26-1, 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.E1.

<u>Operating Experience</u>. LRA Section B.1.26 summarizes operating experience related to the "Non-EQ Insulated Cables and Connections" program.

The applicant's search of site-specific operating experience found no aging mechanisms associated with in-scope non-EQ insulated cables and connections not considered in the GALL Report. The program considers the technical information and industry operating experience provided in publications including: NUREG/CR–5643, SAND 96-0344, IEEE Std. 1205-2000, and EPRI TR-109619. The "Non-EQ Insulated Cables and Connections" is a new program stated to include consideration of industry operating experience when implementing the program and that plant operating experience gained during program implementation will be factored into the program through the applicant's 10 CFR Part 50 Appendix B quality assurance program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects, 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 review of operating experience, including sample CRs and work orders, did not find any significant or unusual operating experience and no previously unknown or recurring aging effects were identified by the applicant or staff. 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.

FSAR Supplement. LRA Section A.1.26 provides the FSAR supplement for the Non-EQ Insulated Cables and Connections program. The staff reviewed this FSAR 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 "Non-EQ Insulated Cables and Connections" program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later, for managing the effects of aging for applicable components (commitment no. 21 as listed in Appendix A).

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit, the applicant's response to RAI B.1.26-1, and review of the applicant's Non-EQ Insulated Cables and Connectors 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 functions(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Oil Analysis

Summary of Technical Information in the Application. LRA Section B.1.27 describes the existing Oil Analysis program as consistent with GALL Report AMP XI.M39 "Lubricating Oil Analysis." The LRA states that the Oil Analysis program ensures that "loss of material and reduction of heat transfer are not occurring by maintaining the quality of the lubricating oil. The program ensures that contaminants (primarily water and particulates) are within acceptable limits. Testing activities include sampling and analysis of lubricating oil for contaminants. Oil testing results that indicate the presence of water initiate corrective action that may include evaluating for in-leakage." Additionally, the LRA states that the One-Time Inspection program "will use inspections or nondestructive evaluations of representative samples to verify that the Oil Analysis program has been effective at managing the aging effects of loss of material and reduction of heat transfer."

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.M39.

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.1.27 summarizes operating experience related to the Oil Analysis program.

The LRA states that in May 2011, in the feedwater pump turbine (FWPT) lube oil, a high water content was identified. The lube oil sight glass was found cloudy and the differential pressure across the high pressure filter was rising. An oil sample from the FWPT lube oil reservoir was collected and analyzed for water content by the predictive maintenance personnel. Actions were completed to replace the lube oil filters and remove the water from the FWPT lube oil.

The LRA states that in December 2008, the applicant identified that the differential pressure across the in-service feed water pump turbine high-pressure lube oil filter exceeded the alert limit of 15 psid. Previous lube oil samples taken were analyzed and the water content was determined to be acceptable at the time of sampling. The applicant removed and installed a new filter, which corrected the deficiency.

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 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.

<u>FSAR Supplement</u>. LRA Section A.1.27 provides the FSAR supplement for the Oil Analysis program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

<u>Conclusion</u>. Based on its audit and review of the applicant's 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 One-Time Inspection

<u>Summary of Technical Information in the Application</u>. LRA Section B.1.28 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 consists of a one-time inspection of selected components to verify the effectiveness of the Diesel Fuel Monitoring program, Oil Analysis program, and Water Chemistry Control program. The One-Time Inspection program also verifies the lack of significant aging of the reactor vessel flange leak detection line and the internal surfaces of the concrete portions of the circulating water intake piping. The aging effects evaluated are loss of material, cracking, and change in material properties. The One-Time Inspection program is intended to confirm the insignificance of an aging effect using inspections that verify unacceptable degradation is not occurring, and to

trigger additional actions if necessary to ensure that the intended functions of affected components are maintained during the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff compared program elements 1 through 6 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M32. 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 in GALL Report AMP XI.M32 recommends evaluating any indication or relevant condition of degradation. However, during its audit, the staff found that the applicant's One-Time Inspection program notes that the program will determine that aging effects are not occurring or are so insignificant that they do not warrant aging management. It was unclear to the staff how it would be determined that an aging effect was insignificant. By letter dated October 12, 2016, the staff issued RAI B.1.28-1 requesting that the applicant explain how it will be determined that cracking or loss of material is acceptable or so insignificant that an AMP is not warranted.

In its response dated November 10, 2016, the applicant stated that any indication or relevant condition will be evaluated. The response also revised LRA Sections A.1.28 and B.1.28 to remove the reference to "unacceptable" aging and revised it to state that the program will confirm that an aging effect is "not occurring or is occurring at a rate that will not cause a loss of intended function."

The staff finds the applicant's response acceptable because the applicant clearly stated any indication will be evaluated. In addition, the LRA was revised to make it clear that all indications will be evaluated to ensure a loss of intended function will not occur during the period of extended operation. The staff's concern described in RAI B.1.28-1 is resolved.

Based on its audit, and review of the applicant's responses to RAI B.1.28-1, 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.M32. The staff finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.28 summarizes operating experience related to the One-Time Inspection program. The LRA states that this is a new program for which there is no plant-specific operating experience indicating a need for aging management. The inspection techniques are consistent with industry practice and use developed and proven industry methods. Future plant-specific and industry operating experience will be reviewed as this program is implemented.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. 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 and that resulted in the issuance of an RAI as discussed below.

The LRA notes that the applicant's One-Time Inspection program includes reinforced concrete portions of the circulating water intake piping exposed to raw water. The GALL Report includes AMR items for concrete piping exposed to raw water and recommends XI.M20, "Open-Cycle Cooling Water System," for managing the effects of aging of this material/environment combination. During the audit, the staff reviewed a report prepared by Pure Technologies US, Inc. summarizing a previous inspection conducted on similar concrete piping in a 132-inch cooling water discharge line. The summary report noted that a majority of the pipe joints exhibited separation and/or spalling and recommended all pipeline joints be cleaned and mortared to prevent corrosion of the joint steel and potential leaks. The report also recommended a re-inspection of the pipeline in approximately 5 years.

By letter dated October 12, 2016, the staff issued RAI B.1.28-2 requesting that the applicant explain why it is appropriate to manage the effects of aging on concrete portions of the circulating water intake piping exposed to raw water via the One-Time Inspection program, considering the guidance in the GALL Report and the operating experience described in the Pure Technologies report.

In its response dated January 9, 2017, and revised March 16, 2017, the applicant stated that the One-Time Inspection program is not the most appropriate program to manage the effects of aging on concrete portions of the circulating water intake piping exposed to raw water. The applicant instead proposed to manage the effects of aging via visual inspections every 10 years, conducted under the Periodic Surveillance and Preventive Maintenance program. A more detailed discussion of the applicant's RAI response, and the staff's review of the response, can be found in the Periodic Surveillance and Preventive Maintenance program write-up in Section 3.0.3.3.1.

The staff finds it acceptable that the applicant removed the concrete portions of the circulating water intake piping from the One-Time Inspection program because the piping will receive reoccurring visual inspection under the Periodic Surveillance and Preventive Maintenance program. The adequacy of this approach is discussed in Section 3.0.3.3.1. The staff's concern, as it relates to the One-Time Inspection program, described in RAI B.1.28-2 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.1.28-2, 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 GALL Report AMP XI.M32 was evaluated.

<u>FSAR Supplement</u>. LRA Section A.1.28 provides the FSAR supplement for the One-Time Inspection program. In response to RAI B.1.28-2, discussed above, the applicant removed the circulating water intake piping internals from the list of inspections conducted under the One-Time Inspection program. In response to RAI B.1.10-4a, dated February 1, 2017, and associated with the External Surfaces Monitoring program, the applicant added plant stack radiation monitor stainless steel tubing to the One-Time Inspection program. The technical adequacy of this addition is discussed in the staff's write-up of the External Surfaces Monitoring program in SER Section 3.0.3.2.6. The staff reviewed the revised FSAR 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 the 10 years prior to the period of extended operation (commitment no. 22 as listed in Appendix A). The staff finds that the information in the FSAR

supplement, as amended by letters dated February 1 and March 16, 2017, is an adequate summary description of the program.

Conclusion. Based on 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 One-Time Inspection – Small-Bore Piping

Summary of Technical Information in the Application. LRA Section B.1.29 describes the One-Time Inspection - Small-Bore Piping program as a new program that is consistent with GALL Report AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." The LRA states that the AMP addresses cracking due to stress corrosion, cyclical (including thermal, mechanical, and vibration fatigue) loading, or thermal stratification and thermal turbulence. The applicant stated that this program augments ASME Code Section XI requirements and is applicable to ASME Code Class 1 piping and components with a nominal pipe size (NPS) diameter less than 4 inches and greater than or equal to 1 inch, in systems that have not experienced cracking of ASME Code Class 1 small-bore piping. The applicant also stated it has not experienced cracking of ASME Code Class 1 small-bore piping due to stress corrosion, cyclical loading, thermal stratification, and thermal turbulence. The applicant further stated that since it has extensive operating history, the program provides for a one-time volumetric or opportunistic destructive inspection of a 3 percent sample or a maximum of 10 ASME Class 1 piping butt weld locations and 3 percent or a sample of 10 ASME Class 1 socket weld locations that are susceptible to cracking.

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. Based on its audit, the staff finds that program elements for which the applicant claimed consistency with the GALL Report, with exception of the "detection of aging effects" program element, are consistent with 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 an RAI as discussed below.

The staff noted that the LRA does not provide the total population of in-scope welds. 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." It is 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 October 12, 2016, the staff issued RAI B.1.29-1 requesting that applicant provide the population of in-scope small-bore piping welds for each weld type (e.g., butt welds and

socket welds) and to describe the inspection sample size for each weld type based on the total population of in-scope welds.

In its response dated December 12, 2016, the applicant stated that there are 371 in-scope small-bore piping butt welds and 216 in-scope small-bore piping socket welds. The applicant stated that based on the GALL Report guidance, it will volumetrically examine 10 butt welds and seven socket welds.

The staff noted that the applicant's response provided specific information on the total number of small-bore piping weld populations for butt welds and socket welds. The staff also noted that the applicant provided justification on its sampling methodology consistent with the GALL Report guidance. The staff finds the applicant's response acceptable because, based on the applicant's plant-specific operating experience (more than 30 years of operation at the time of application for license renewal and no incidence of failures observed for its ASME Class 1 small-bore piping), its sample size is consistent with the 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. The staff's concern described in RAI B.1.29-1 is resolved.

Operating Experience. LRA Section B.1.29 summarizes operating experience related to the One-Time Inspection - Small-Bore Piping program. The applicant indicated that this is a new program and it does not have any plant-specific operating experience related to cracking of ASME Class 1 small-bore piping. The LRA states that industry operating experience will be considered in its application of the program. The LRA also states that plant-specific operating experience will be gained as the program is implemented and will be factored into the program through its corrective action program and quality assurance 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 implementation of the program will result 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.M35 was evaluated.

FSAR Supplement. LRA Section A.1.29 provides the FSAR supplement for the One-Time Inspection - Small-Bore Piping program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's One-Time Inspection - Small-Bore Piping 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.15 Reactor Vessel Surveillance

Summary of Technical Information in the Application. LRA Section B.1.34 describes the existing Reactor Vessel Surveillance program as consistent with GALL Report AMP XI.M31, “Reactor Vessel Surveillance.” This program manages reduction of fracture toughness and long-term operating conditions for reactor vessel beltline materials using material data and dosimetry. The program includes all reactor vessel beltline materials as defined by 10 CFR Part 50 Appendix G, Section II.F, and complies with 10 CFR Part 50, Appendix H for reactor vessel material surveillance.

The objective of this program is to provide sufficient material data and dosimetry to (a) monitor irradiation embrittlement at the end of the period of extended operation and (b) establish operating restrictions (e.g., coolant inlet temperature and neutron flux). Capsules are periodically withdrawn from the reactor vessel in accordance with an NRC-approved withdrawal schedule. Capsules are tested and reported in accordance with American Society for Testing and Materials (ASTM) E 185-82 to the extent practicable. One capsule will be withdrawn during an outage in which the capsule receives a neutron fluence of between one and two times the peak reactor vessel wall neutron fluence at the end of 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.M31. For the “detection of aging effects” and “scope of program” 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 of 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 one and two 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. GALL Report AMP XI.M31 also states that, in accordance with 10 CFR Part 50, Appendix H, an applicant submits its proposed withdrawal schedule for approval prior to implementation. Specifically, Section III.B.3 of 10 CFR Part 50, Appendix H, states that a proposed withdrawal schedule must be submitted with a technical justification as specified in 10 CFR 50.4 and that the proposed schedule must be approved prior to implementation.

During the audit, the staff noted that the applicant identified a need to withdraw and test Capsule 277° at 48 effective full-power years (EFPY) to represent the fluence exposure for the period of extended operation, as recommended in LRA Reference 4-11 (i.e., WCAP-18002-NP, Revision 0, “Waterford Unit 3 Time-Limited Aging Analysis on Reactor Vessel Integrity,” July 2015). The staff also noted that the applicant did not submit a capsule withdrawal schedule for Capsule 277° for NRC approval in accordance with 10 CFR Part 50, Appendix H. The staff noted that the absence of a staff-approved capsule withdrawal schedule for this capsule could affect the effectiveness of the program in providing neutron embrittlement data.

By letter dated October 11, 2016, the staff issued RAI B.1.34-1 requesting that the applicant justify why the absence of a staff-approved withdrawal schedule for Capsule 277° does not affect the program's effectiveness. The staff also requested that alternatively the applicant submit a withdrawal schedule for Capsule 277° to obtain NRC approval in accordance with 10 CFR Part 50, Appendix H, as part of program implementation.

In its response dated November 10, 2016, the applicant stated that, for the capsule located at 277°, WCAP-18002-NP suggested a removal time of the reactor vessel refueling outage nearest to 48 EFPY. The applicant further stated that the estimated fluence for the capsule at 48 EFPY is 4.51×10^{19} n/cm^2 providing a fluence greater than the peak reactor vessel inner radius fluence calculated for 55 EFPY of 4.32×10^{19} n/cm^2.

In addition, the applicant stated that the WF3 commitment management system includes a commitment to submit a reactor vessel surveillance capsule withdrawal schedule for future removal of the capsule located at 277°. The applicant also indicated that these actions, described in the applicant's response to the RAI, are consistent with the program description of GALL Report AMP XI.M31, which states that a change to the capsule withdrawal schedule must be submitted to the NRC for approval prior to implementation.

In its review of the applicant's response, the staff noted that the "detection of aging effects" program element of GALL Report AMP XI.M31 states that the withdrawal schedule shall be submitted as part of an LRA for NRC review and approval in accordance with 10 CFR Part 50, Appendix H. The staff noted that because the applicant did not submit a withdrawal schedule for Capsule 277° as part of the LRA, it was not consistent with GALL Report AMP XI.M31.

By letter dated December 8, 2016, the staff issued RAI B.1.34-1a requesting that the applicant explain why the program is consistent with GALL Report AMP XI.M31 even though the applicant did not submit a withdrawal schedule for Capsule 277° as part of the LRA.

In its response dated January 19, 2017, the applicant stated that the WF3 commitment management system includes a commitment to submit a reactor vessel surveillance capsule withdrawal schedule for future removal of the capsule located at 277°. The applicant further indicated that finalization of the revised surveillance capsule withdrawal schedule is pending confirmation of the staff's acceptance of the neutron fluence calculation method used for capsule withdrawal schedule determination.

In addition, the applicant indicated that a program exception is identified because the revised schedule is not ready for submittal as part of the LRA.

In its review of the applicant's response, the staff noted that the applicant did not provide the current EFPY of WF3. The staff also noted that, because the Reactor Vessel Surveillance program is an existing program as required by Appendix H to 10 CFR Part 50, the program establishes and maintains staff-approved reactor vessel surveillance capsule withdrawal schedules for the license term. Given the applicant's program exception that a withdrawal schedule for Capsule 277° is not submitted as part of the LRA, the staff noted that the applicant should submit the capsule withdrawal schedule for staff review and approval (in accordance with 10 CFR Part 50, Appendix H) within a specific time period following the receipt of a renewed license (e.g., within 1 year following the receipt of a renewed license).

By letter dated March 1, 2017, the staff issued RAI B.1.34-1b requesting that the applicant (1) provide the current EFPY of the unit and (2) identify a program enhancement to submit a

withdrawal schedule for Capsule 277° for staff review and approval within a specific time period following the receipt of a renewed license.

In its response dated March 30, 2017, the applicant stated that, as of March 1, 2017, WF3 had accrued approximately 27 EFPY of plant operation. The applicant also indicated that a program enhancement is identified to specify submittal of a capsule withdrawal schedule for review and approval within 1 year following the receipt of the renewed license. The applicant further clarified that the surveillance capsule located at 277° will be removed at approximately 48 EFPY with a neutron fluence of between one and two times the peak reactor vessel wall neutron fluence at the end of the period of extended operation, consistent with the guidance in the GALL Report. In addition, the applicant revised the program exception submitted in the January 19, 2017, response to be consistent with this program enhancement.

In its response, the applicant also revised LRA Section B.1.34 (Reactor Vessel Surveillance program), Section A.1.34 (FSAR supplement for the program), Section A.4 License Renewal Commitment List, and Table B-3 (program consistency with the GALL Report), consistent with the enhancement.

The staff finds the applicant's response acceptable because (1) the applicant provided the baseline information on the current EFPY compared to the withdrawal schedule for Capsule 277° at 48 EFPY; (2) the applicant identified a program enhancement to submit the withdrawal schedule for Capsule 277° for staff review and approval within 1 year following the receipt of the renewed license; (3) the applicant confirmed that the capsule withdrawal schedule is consistent with the guidance on the capsule fluence range in GALL Report AMP XI.M31 (i.e., between one and two times the peak reactor vessel wall fluence projected at the end of the period of extended operation); (4) the applicant adequately identified a program exception that prompted the program enhancement; and (5) the applicant revised the LRA, including the program and FSAR sections, consistent with the program enhancement and exception. The staff's concern described in RAIs B.1.34-1, B.1.34-1a, and B.1.34-1b is resolved.

The "scope of program" program element of GALL Report AMP XI.M31 states that the program includes all reactor vessel beltline materials as defined by 10 CFR Part 50, Appendix G, Section II.F. LRA Section 4.2.1 and Table 4.2-1 identify the WF3 reactor vessel beltline materials that are exposed to 60-year (55-EFPY) fluence greater than 1×10^{17} n/cm^2 (E > 1 MeV). Specifically, LRA Table 4.2-1 indicates that 55-EFPY fluence for the upper shell plates and welds at the clad/metal interface is 5.82×10^{17} n/cm^2 (E > 1 MeV).

The staff also noted that the 40-year (32-EFPY) fluence for these upper shell plates and associated welds is approximately estimated as 3.37×10^{17} n/cm^2 (E > 1 MeV) by linear interpolation. This fluence estimate suggests that these upper shell materials are also identified as beltline materials for 32 EFPY. However, the staff noted that these upper shell materials are not identified as beltline materials in the evaluation for the 32-EFPY pressure-temperature (P-T) limits described in WCAP-16088-NP, Revision 1, "Waterford Unit 3 Reactor Vessel Heatup and Cooldown Limit Curves for Normal Operation," September 2003 (ADAMS Accession No. ML041620063). Specifically, Table 2-2, "Summary of the Waterford Unit 3 Reactor Vessel Beltline Material Chemistry Factors," in WCAP-16088-NP, Revision 1, does not identify these upper shell materials as reactor vessel beltline materials.

By letter dated October 12, 2016, the staff issued RAI B.1.34-2 requesting that the applicant address this potential inconsistency in identifying the upper shell plates and welds as reactor vessel beltline materials between the 32-EFPY evaluation and 55-EFPY evaluation.

In its response dated December 12, 2016, the applicant indicated that the reactor vessel beltline is the region (shell material including welds, heat affected zones, and plates or forgings) that directly surrounds the effective height of the active core and adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the limiting material with regard to radiation damage. The applicant also indicated that, in the 32-EFPY evaluation (WCAP-16088-NP, Revision 1), Westinghouse did not identify the upper shell plates and welds as part of the beltline because these materials were deemed materials that were not limiting with regard to radiation damage.

In addition, the applicant indicated that in the 55-EFPY evaluation (WCAP-18002-NP, July 2015) the materials that exceed 1.0×10^{17} n/cm^2 (E > 1 MeV) fast neutron fluence were evaluated to determine the effect of neutron irradiation embrittlement during the period of extended operation. The applicant stated that this provides assurance that materials meeting the 10 CFR Part 50, Appendix G, definition of beltline at the end of the period of extended operation have been adequately evaluated for the effects of neutron irradiation. The applicant also noted that linear interpolation from the 55-EFPY fluence is not expected to yield an accurate estimate of the 32-EFPY fluence because the WF3 power uprate in 2005 resulted not only in a higher average fluence in the core, but also a different neutron flux distribution than evaluated in the 2003 determination of P-T limits documented in WCAP-16088-NP, Revision 1.

The staff finds the applicant's response acceptable because the applicant clarified that (a) the 32-EFPY evaluation did not identify the upper shell plates and associated welds as part of the beltline region based on the determination that these materials were not the limiting materials in terms of irradiation embrittlement, and (b) the 55-EFPY evaluation for license renewal adequately identified these materials as part of the beltline region for the extended period of operation. The staff's concern described in RAI B.1.34-2 is resolved.

Exception. As discussed previously, the staff identified a difference in the "detection of aging effects" program element between the applicant's program and GALL Report AMP XI.M31. In this difference, the staff noted that the applicant did not submit a reactor vessel surveillance capsule withdrawal schedule, which addresses the period of extended operation, as part of the LRA. The staff issued RAIs B.1.34-1, B.1.34-1a, and B.1.34-1b as discussed above. The applicant provided a program exception in its letter dated January 19, 2017, as supplemented by the March 30, 2017, letter.

The program exception indicates that the GALL Report recommends that a reactor vessel surveillance capsule withdrawal schedule be submitted as part of the LRA. The exception also indicates that WF3 will submit the revised capsule withdrawal schedule separate from the LRA but prior to implementation within 1 year following receipt of the renewed license.

The staff finds this program exception acceptable because (1) the applicant confirmed that the capsule withdrawal schedule for the extended period of operation (i.e., withdrawal schedule for Capsule 277°) is consistent with the capsule fluence range recommended in GALL Report AMP XI.M31 (i.e., between one and two times the peak reactor vessel wall fluence projected at the end of the period of extended operation); and (2) the program exception also acknowledges the need for the program enhancement that addresses a timely submittal of the withdrawal schedule for Capsule 277° for staff review and approval.

Enhancement. As discussed previously, the applicant identified an enhancement to the "detection of aging effects" program element in its letter dated March 30, 2017. In this enhancement, the applicant stated that it will revise Reactor Vessel Surveillance program

procedures to specify submittal of a withdrawal schedule for Capsule 277° to the NRC for review and approval within 1 year following the receipt of the renewed license. The applicant also indicated that the program enhancement will be implemented within 1 year following the receipt of the renewed operating license.

As evaluated previously, the staff finds this enhancement acceptable because (1) when it is implemented, a staff-approved capsule withdrawal schedule will be established in a timely manner for the period of extended operation; and (2) the applicant confirmed that the capsule withdrawal schedule for the extended period of operation is consistent with the guidance on the capsule fluence range recommended in GALL Report AMP XI.M31.

Based on its audit, and review of the applicant's responses to RAIs B.1.34-1, B.1.34-1a, B1.34-1b, and B.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.31.

The staff also reviewed the exception, which addressed the staff-identified difference between the applicant's program and GALL Report AMP XI.M31, and its justification. In its review, the staff finds that the AMP, with the exception, is adequate to manage the applicable aging effects. In addition, the staff reviewed the enhancement associated with the "detection of aging effects" program element and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.34 summarizes operating experience related to the applicant's Reactor Vessel Surveillance program. The applicant described the withdrawal and testing of surveillance capsule specimens that were conducted in March 2003, and March 2015, in accordance with the Reactor Vessel Surveillance program. The applicant also indicated that the testing and fluence analysis results associated with the March 2015 specimens were evaluated and the evaluation results confirmed that beltline material properties remain acceptable to support continued safe plant operations through 32 EFPY.

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.

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.M31 was evaluated.

FSAR Supplement. LRA Section A.1.34 provides the FSAR supplement for the applicant's Reactor Vessel Surveillance program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1.

In contrast with the FSAR supplement in SRP-LR, Revision 2, the staff noted that LRA Section A.1.34 does not include the following important attributes of the program: (a) any

changes to the capsule withdrawal schedule, including spare capsules, must be approved by the NRC prior to implementation; and (b) untested capsules placed in storage must be maintained for future insertion. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information into its FSAR supplement.

By letter dated October 11, 2016, the staff issued RAI B.1.34-3 requesting that the applicant justify why the applicant's FSAR supplement for the program summary description does not include these important program attributes consistent with the FSAR supplement in Table 3.0-1 of the SRP-LR, Revision 2.

In its response dated November 10, 2016, the applicant revised LRA Sections A.1.34 and B.1.34 to include (a) any changes to the capsule withdrawal schedule, including the withdrawal schedule for spare capsules, must be approved by the NRC prior to implementation, and (b) untested capsules placed in storage must be maintained for future insertion. The staff finds the applicant's response acceptable because this FSAR supplement was adequately revised to include the important program attributes that the previous FSAR supplement had omitted. The staff also finds that the FSAR 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.1.34-3 is resolved.

As previously discussed, the staff also noted that the applicant committed to implement the enhancement to the program within 1 year following the receipt of the renewed operating license (commitment no. 34 as listed in Appendix A), and this enhancement is adequately identified in the FSAR supplement. The staff finds that the information in the FSAR supplement, as amended by letters dated November 10, 2016, and March 30, 2017, is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Reactor Vessel Surveillance program and responses to RAIs B.1.34-1, B.1.34-1a, B.1.34-1b, B.3.1.34-2, and B.1.34-3, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M31. In addition, the staff reviewed the exception, which addressed the staff-identified difference between the applicant's program and GALL Report AMP XI.M31, and its justification. The staff determines that the AMP, with the exception, is adequate to manage the applicable aging effects. Also, the staff reviewed the enhancement and confirmed that its implementation within 1 year following the receipt of the renewed operating license 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 reviewed the FSAR supplement for this AMP and finds that the information in the FSAR supplement, as amended by letters dated November 10, 2016, and March 30, 2017, is an adequate summary description of the program.

3.0.3.1.16 Selective Leaching

Summary of Technical Information in the Application. LRA Section B.1.35 describes the new Selective Leaching program as consistent with GALL Report AMP XI.M33, "Selective Leaching," as modified by 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 AMP addresses gray cast iron and copper alloys (except

inhibited brass) that contain greater than 15 percent zinc or 8 percent aluminum exposed to condensation, raw water, waste water, treated water, or soil to manage the effects of loss of material due to selective leaching. The LRA also states that the AMP proposes to manage this aging effect through one-time visual inspections coupled with mechanical examination techniques of a representative sample of each material and environment combination.

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 7 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M33, "Selective Leaching," as modified by LR-ISG-2011-03.

For the "corrective actions" program element, the staff determined the need for additional information, which resulted in the issuance of an RAI, as discussed below.

The "corrective actions" program element of the GALL Report AMP XI.M33 recommends that, "[u]nacceptable inspection findings result in additional inspection(s) being performed, which may be on a periodic basis, or in component repair or replacement." However, during its audit, the staff found that the applicant's Selective Leaching program description states: "[f]ollow-up for unacceptable inspection findings includes an evaluation using the corrective action program and possible expansion of the inspection sample size and location." LRA Section B.1.35, as well as LRA Section A.1.35, is not consistent with GALL Report AMP XI.M33, which recommends that additional inspections will be conducted when inspections result in unacceptable results; whereas, the LRA AMP and FSAR supplement state that there might be additional inspections. By letter dated September 15, 2016, the staff issued RAI B.1.35-1 requesting that the applicant state the criteria, and their basis, for determining that an expansion of the inspection sample size and location would not occur if unacceptable inspection findings are detected during inspections for loss of material due to selective leaching.

In its response dated October 13, 2016, the applicant revised LRA Sections B.1.35 and A.1.35 to state: "[f]ollow-up of unacceptable inspection findings includes an evaluation using the corrective action program and expansion of the inspection sample size and location."

The staff noted that the applicant's program as originally proposed was consistent with statements in the "detection of aging effects" program element in AMP XI.M33, which state that there should be a possible expansion of samples. However, the "corrective actions" program element stated more proscriptive recommendations related to unacceptable inspection findings in that additional inspections are recommended to be conducted. The staff finds the applicant's response acceptable because the Selective Leaching program is consistent with the more proscriptive recommendations of GALL Report AMP XI.M33. The staff's concern described in RAI B.1.35 1 is resolved.

Based on its audit, and review of the applicant's response to RAI B.1.35 1, the staff finds that program elements 1 through 7 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M33, "Selective Leaching," as modified by LR-ISG-2011-03.

Operating Experience. LRA Section B.1.35 summarizes operating experience related to the Selective Leaching program. The applicant stated that the Selective Leaching program is a new program and plant operating experience will be obtained as it is implemented.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. 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.M33 was evaluated.

FSAR Supplement. LRA Section A.1.35, as amended by letter dated October 13, 2016, provides the FSAR supplement for the Selective Leaching program. The staff reviewed this FSAR 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 prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later, for managing the effects of aging for applicable components (commitment no. 28 as listed in Appendix A).

The staff finds that the information in the FSAR supplement, as amended by letter dated October 13, 2016, is an adequate summary description of the program.

Conclusion. Based on 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. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 Steam Generator Integrity

Summary of Technical Information in the Application. LRA Section B.1.37, as updated by letter dated March 16, 2017, describes the existing Steam Generator Integrity program as consistent, with enhancement, with the GALL Report AMP XI.M19, "Steam Generators." The LRA states that the Steam Generator Integrity program manages aging effects for SG tubes, plugs, sleeves, and secondary side components within the SG in accordance with the plant TS and commitments to NEI 97-06. Preventive and mitigative measures include foreign material exclusion programs and other primary and secondary side maintenance activities. The program has acceptance criteria for when a tube should be plugged based on wall thickness measurements. Condition monitoring assessments are performed to confirm that adequate tube integrity has been maintained since the previous inspection and operational assessments are performed to ensure that tube integrity will be maintained until the next scheduled inspection. The acceptance criteria are in accordance with the TS.

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.M19. For the "parameters monitored and 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 "parameters monitored and inspected" and "detection of aging effects" program elements in GALL Report AMP XI.M19, as revised in LR-ISG-2016-01, include visual inspections of divider plate assemblies, tube-to-tubesheet welds, channel heads, and tubesheets to identify signs that cracking or loss of material may be occurring. These program elements also specify inspections to be performed at least every 72 effective full-power months or every third refueling outage, whichever results in more frequent inspections. However, during its review, the staff noted that the Steam Generator Integrity program did not specify visual inspections of these components nor the recommended frequencies. By letter dated November 7, 2016, the staff issued RAIs 3.1.1.88-1 and B.1.37-1 requesting that the applicant clarify the inspections that would be performed to address the recommendations in LR-ISG-2016-01. By letter dated February 14, 2017, the staff issued followup RAIs 3.1.1.88-1a and B.1.37-1a requesting further clarification.

In its responses dated December 7, 2016, and March 16, 2017, the applicant stated that LRA Section B.1.37 (program description) is revised to include periodic general visual inspections of SG channel head internal areas exposed to treated borated water to verify no rust stains, discoloration, or distortion of the cladding that could indicate loss of material due to boric acid corrosion of base metals resulting from a breach of the cladding. The applicant also stated that the areas are visually inspected at least once every 72 effective full-power months or every third refueling outage, whichever results in more frequent inspections and added the visual inspection frequency to the FSAR supplement (LRA Section A.1.37). In addition, the applicant indicated that the detection of cracking due to PWSCC is not feasible with general visual inspections. The staff noted that, although these visual inspections are not intended to directly detect cracking due to PWSCC, they can identify signs that cracking or loss of material is occurring in SG channel head components (e.g., detection of rust stains).

The staff finds the applicant's response acceptable because (1) the applicant's program includes visual inspections that will detect rust stains, discoloration, or distortion of the cladding, consistent with LR-ISG-2016-01; (2) the frequency of the inspections is also consistent with LR-ISG-2016-01; (3) these visual inspections can reveal the occurrence of loss of material due to boric acid corrosion in the channel head base material as well as PWSCC when it propagates into the steel base material; and (4) the divider plate assemblies, including associated welds, and tube-to-tubesheet welds exposed to the treated water environment are fabricated with Alloy 690 type materials, which are resistant to PWSCC. The staff's concerns described in RAIs 3.1.1.88-1, B.1.37-1, 3.1.1.88-1a, and B.1.37-1a are resolved.

The staff also reviewed the portions of the "detection of aging effects" program element associated with 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.1.37, as revised by letter dated March 16, 2017, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Steam Generator Integrity program would be revised to include general visual inspection of the partition plate, channel head, and tubesheet (primary side) with a

frequency of at least once every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M19 and finds it acceptable because when it is implemented it will require a frequency that can reasonably identify signs that are indicative of loss of material of the base metal.

Based on its audit, and review of the applicant's responses to RAIs 3.1.1.88-1, B.1.37-1, 3.1.1.88-1a, and B.1.37a, 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.M19. In addition, the staff reviewed the enhancement associated with the "detection of aging effects" program element and finds that, when implemented, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.37 summarizes operating experience related to the Steam Generator Integrity program. The applicant provided the following operating experience.

In 2006, the applicant performed an assessment of its Steam Generator Management program to determine if the program implemented the requirements of NEI 97-06, "Steam Generator Program Guidelines." The assessment team determined that program compliance had been satisfactory and was improving. Two areas of improvement were identified. The first area related to raising the scope of work for SG inspections. To address this, the applicant recommended revisions to site procedures to challenge the SG tube eddy current inspection scope prior to issuing vendor contract requisitions. The second area pertained to improving actions towards loose parts in SGs to meet industry standards.

The SGs were replaced in 2012. In response to the San Onofre Nuclear Generating Station tube rupture in January 2012, the applicant performed supplemental inspections in conjunction with the SG preservice inspection. In 2014, the first ISI for the replacement SGs was completed and identified little degradation. No tubes were found to contain eddy current indications that could potentially challenge tube integrity.

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, review of the application, and review of the applicant's responses to RAIs 3.1.1.88-1, B.1.37-1, 3.1.1.88-1a, and B.1.37-1a, 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.M19 was evaluated.

FSAR Supplement. LRA Section A.1.37 provides the FSAR supplement for the Steam Generator Integrity program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1.

In its review, the staff noted that LRA Section A.1.37 did not specify visual inspections of the primary channel head internal surfaces nor the inspection frequencies. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information into its FSAR supplement. By letters dated November 07, 2016, and February 14, 2017, the staff issued RAIs 3.1.1.88-1 and B.1.37-1a requesting that the applicant justify these discrepancies with the recommendations in LR-ISG-2016-01.

In its responses dated December 7, 2016, and March 16, 2017, the applicant stated that LRA Section A.1.37 is revised to specify that visual inspections of SG internal areas are performed at least once every 72 effective full-power months or every third refueling outage, whichever results in more frequent inspections, and will verify no rust stains, discoloration, or distortion of the cladding that could indicate loss of material due to boric acid corrosion of base metals resulting from a breach of the cladding. As discussed previously, the staff finds the applicant's response acceptable because it specifies visual inspections for the channel head internal surfaces at intervals no greater than those recommended in LR-ISG-2016-01. The staff's concern described in RAIs 3.1.1.88-1 and B.1.37-1a is resolved.

The staff finds that the information in the FSAR supplement, as amended by letter dated March 16, 2017, is an adequate summary description of the program.

Conclusion: Based on its audit and review of the applicant's Steam Generator Integrity program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.18 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

Summary of Technical Information in the Application. LRA Section B.1.39 describes the new Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program as consistent with GALL Report AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)." The LRA states that the program addresses reduction in fracture toughness and cracking. The LRA states that the program consists of a determination of the susceptibility of CASS piping, piping components, and piping elements to thermal aging embrittlement based on casting method, molybdenum content, and ferrite content. The LRA also states that the program proposes to manage these aging effects on susceptible components through qualified visual inspections, such as enhanced visual examination, qualified ultrasonic testing (UT) methodology, or component-specific flaw tolerance evaluation in accordance with 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.M12.

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.M12. The staff finds that the AMP is adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.39 summarizes operating experience related to the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program. The LRA states that plant-specific operating experience at WF3 was reviewed and that no operating experience associated with this aging effect was found. The LRA states that as the program is being implemented, plant-specific and industry operating experience will be gained and factored into the program using the confirmation and corrective action elements of its Quality Assurance 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. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M12 was evaluated.

FSAR Supplement. LRA Section A.1.39 provides the FSAR supplement for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program. The staff reviewed this FSAR 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 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program 6 months prior to the period of extended operation for managing the effects of aging for applicable components (commitment no. 31 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.19 Water Chemistry Control – Primary and Secondary

Summary of Technical Information in the Application. LRA Section B.1.41 describes the existing Water Chemistry Control – Primary and Secondary program as consistent with GALL Report AMP XI.M2, "Water Chemistry." The LRA states that the Water Chemistry Control – Primary and Secondary program "manages loss of material, cracking, and reduction of heat transfer in components in an environment of treated water through periodic monitoring and control of water chemistry." The LRA also states that the Water Chemistry Control – Primary

and Secondary program “monitors and controls water chemistry parameters such as pH, chloride, fluoride, and sulfate to keep peak levels of various contaminants below system specific limits.” Additionally, the LRA states that the One-Time Inspection program will be used to verify that the Water Chemistry Control – Primary and Secondary program has been effective at managing the effects of aging.

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.

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.M2.

Operating Experience. LRA Section B.1.41 summarizes operating experience related to the Water Chemistry Control – Primary and Secondary program.

The applicant stated that in April 2008, hydrogen peroxide was added to the RCS prior to boron equalization and prior to reaching refueling boron concentration in the pressurizer. This impaired the ability to adequately mix the RCS and pressurizer. The procedure was revised to specify that RCS boration and boron equalization shall be complete prior to adding hydrogen peroxide to the RCS.

The applicant stated that in June 2008, elevated conductivity levels were noted following a refueling outage. The applicant also stated the following:

> The levels were higher than recorded in the previous outage. RCS conductivity is a diagnostic parameter without specification. Other monitored parameters, such as sodium, chloride, sulfate, fluoride, oxygen, ammonia, and lithium, were within specifications and at normal levels for exiting a refueling outage. RCS conductivity returned to typical values within a few days following startup. No other monitored parameters were elevated in an atypical fashion during startup.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-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.M2 was evaluated.

FSAR Supplement. LRA Section A.1.41 provides the FSAR supplement for the Water Chemistry Control – Primary and Secondary program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended

description in SRP-LR Table 3.0-1. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Water Chemistry Control – Primary and Secondary 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 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:

- Bolting Integrity
- Coating Integrity
- Compressed Air Monitoring
- Containment Inservice Inspection – IWE
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fatigue Monitoring
- Fire Protection
- Fire Water System
- Flow-Accelerated Corrosion
- Inservice Inspection – IWF
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Neutron-Absorbing Material Monitoring
- Non-EQ Inaccessible Power Cables (≥ 400 V)
- Protective Coating Monitoring and Maintenance
- Reactor Head Closure Studs
- Reactor Vessel Internals
- Service Water Integrity
- Structures Monitoring
- Water Chemistry Control – Closed Treated Water Systems

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 AMPs to which they are compared. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 Bolting Integrity

Summary of Technical Information in the Application. LRA Section B.1.1 describes the existing Bolting Integrity program as consistent, with an exception and enhancements, with GALL Report AMP XI.M18, "Bolting Integrity." The LRA states that the AMP manages the aging effects of cracking, loss of preload, and loss of material of pressure-retaining closure bolts. The LRA also states that the AMP proposes to manage these aging effects through periodic inspections (visual inspections), performed at least once per refueling outage, of ASME Code Class 1, 2, and 3 and non-ASME Code Class closure bolts. During these periodic inspections, closure bolts are inspected for indications of cracking, loss of preload, loss of material, and leakage. To prevent these aging effects, the AMP includes preventive actions such as the selection of material with actual yield strength less than 150 ksi, appropriate application of preload, restricting the use of molybdenum disulfide (MoS_2) lubricants, and checking the uniformity of gasket compression. The LRA also states that 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," Electric Power Research Institute (EPRI) NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," and EPRI TR-104213, "Bolted Joint Maintenance and Applications Guide."

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.

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 "detection of aging effects" program element in GALL Report AMP XI.M18 recommends performing periodic inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation before component leakage becomes excessive. Based on its LRA review and onsite review of program basis documents, the staff noted that although the applicant's Enhancement 1 to the Bolting Integrity program states that program procedures will be revised to include submerged closure bolting, the Bolting Integrity program lacked information regarding the location, frequency, and method(s) of inspections for the submerged closure bolting. Also, a submerged environment limits the ability to perform the recommended visual inspections and detect leakage of closure bolted connections. Therefore, by letter dated September 15, 2016, the staff issued RAI B.1.1-1 requesting that the applicant state the location of the submerged closure bolting and describe the frequency and method(s) of inspection to be used to detect loss of material and loss of preload of the submerged closure bolts.

In its response dated October 13, 2016, the applicant stated that it incorrectly identified in LRA Table 3.2.2-3, "Containment Penetrations," bolting in the fuel transfer tube flange cover as

submerged bolting in treated borated water. The applicant clarified that this bolting, when installed, is only exposed to an air-indoor environment because the flange cover and bolts are removed when the fuel transfer tube flange is submerged during refueling activities. As a result, the applicant deleted two AMR items for stainless steel bolting exposed to treated borated water from LRA Table 3.2.2-3. The applicant also stated that the submerged bolts are in a waste water environment in the submerged discharge piping pressure-retaining connections of the four dry cooling tower (DCT) area sump pumps. The pumps and associated discharge piping bolting connections are located in two concrete sumps that are approximately 4 ft. in diameter and 9 ft. deep, and for inspection of the submerged bolts the use of a crane is required to remove the pump and submerged bolted connection. The applicant also stated, in part, the following:

> Since both sump pumps for each DCT area sump have a common discharge line, the removal of one pump renders both pumps unavailable and in modes 1 thru 4 requires WF3 to enter the ultimate heat sink Technical Specifications action statement for that DCT. Aging management activities will include opportunistic inspection of the normally inaccessible submerged bolted connection on each DCT area sump pump. […] In addition, each DCT area sump pump is flow-tested at least once every seven years. An acceptable flow test indicates that the submerged bolted connection is not degraded due to loss of material or loss of preload such that the intended function cannot be met. […] Degradation detected during the periodic flow test or opportunistic inspection would be entered into the corrective action program [(CAP)] for further investigation.

The applicant further stated that based on its review of operating experience and maintenance records dating back to 1987, there are no indications of loss of intended function for the DCT sump pumps submerged bolting; therefore, the monitoring methods (frequency of pump flow testing and opportunistic inspections) are effective in managing the applicable aging effects. As part of its response, the applicant revised LRA Sections A.1.1 and B.1.1 to clarify its Exception 1 to the "detection of aging effects" program element that the DCT sump pump submerged bolting will not be periodically inspected. LRA Sections A.1.1 and B.1.1 were also revised to add a new enhancement (Enhancement 4) to the Bolting Integrity program "detection of aging effects" program element. Enhancement 4 states that the AMP will be revised to specify opportunistic inspections of the submerged DCT area sump pump discharge bolting.

SRP-LR Section A.1.2.3.10 states that the AMP frequency of inspections may be linked to plant-specific or industrywide operating experience, and a discussion should provide justification that the frequency is adequate to detect the aging effects before there is a loss of SC intended functions. The staff reviewed the applicant's response and given that opportunistic inspections may not occur during the period of extended operation, the staff did not determine that a 7-year frequency for conducting pump flow tests would be adequate to allow for timely detection of degradation of the submerged closure bolts. Opportunistic inspection in conjunction with testing of pump flow every 7 years may result in inspections and/or testing not done frequently enough to detect the aging effects of loss of material and loss of preload of the submerged bolts before there is a loss of intended function. The SRP-LR also states that the detection of aging effects should occur before there is a loss of the SC's intended function and a program based solely on detecting SC failures is not considered an effective AMP. Although the applicant stated that a review of operating experience and maintenance records showed no loss of intended function to date, the staff notes that absence of loss of intended function to date does not demonstrate the program effectiveness for adequate and timely detection of aging effects for long-lived passive SCs. The staff needed additional information to understand how the Bolting Integrity program

frequency and method(s) of inspections will be adequate to detect loss of material and loss of preload in submerged bolts before there is a loss of intended function. Therefore, by letter dated November 15, 2016, the staff issued followup RAI B.1.1-1a requesting that the applicant provide the technical basis supporting the selected frequency and to provide additional information to demonstrate that the AMP methods and frequency of inspections will ensure that the aging effects of loss of material and loss of preload for the submerged bolts will be timely detected and adequately managed before there is a loss of intended function.

In its response dated December 15, 2016, the applicant stated that since 1987, it has replaced two of the four DCT area sump pumps as part of maintenance activities at the site. The applicant also stated: "[a]s part of their rounds, operations personnel inspect the two [DCT] area sumps every shift" and sump levels are monitored such that if the DCT area sump pumps do not maintain acceptable sump levels a control room alarm will alert operators. The applicant further stated that the "frequency of pump flow testing and opportunistic inspections, along with the daily sump monitoring and control room equipment monitoring by operations personnel have been shown effective in managing the applicable aging effects to prevent a loss of intended function of the DCT area sump pump submerged bolting."

The staff noted that the applicant has previously accessed the area twice to replace two of the DCT area sump pumps as part of its maintenance activities. The staff also notes that similar maintenance activities may be performed during the period of extended operation and at these times the applicant will have access to the submerged bolts and, therefore, would be able to perform an opportunistic inspection. The staff notes that the daily inspection of the DCT area sump by plant operators and monitoring of sump levels at the control room allow for the early identification of signs of leakage from the submerged bolted connections and the detection of the related aging effects of loss of material and loss of preload. In addition, the staff notes that signs of leakage, which may be the result of loss of material and loss of preload, can also be identified during the performance of pump flow tests. The staff finds the applicant's response and proposal to manage loss of material and loss of preload for closure bolts submerged in waste water using the Bolting Integrity program acceptable because the program includes opportunistic inspection of the normally inaccessible submerged bolting, and is supplemented by flow-testing for each of the DCT area sump pumps, which will be performed at least once every 7 years and any degraded results will be entered into the corrective action program; inspections of the two DCT area sumps are conducted every shift by the operations personnel; and the sump levels are monitored in the control room with an alarm to alert operators if the DCT area sump pumps are not maintaining acceptable levels. Therefore, the staff has reasonable assurance that the aging effects for submerged DCT area sump pump bolting will be detected prior to a loss of intended function. The staff's concerns described in RAIs B.1.1-1 and B.1.1-1a are resolved.

The LRA credits the Bolting Integrity program to manage closure bolting of systems that contain clear gaseous fluids (e.g., nitrogen system, gaseous waste management system, and auxiliary steam system). The staff notes that it is difficult to visually detect leakage of clear gaseous fluids and, although the "detection of aging effects" program element of GALL Report AMP XI.M18 recommends periodic visual inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation, it does not provide specific guidance for the detection of leakage of clear gaseous fluids from a bolted connection. It is not clear how signs of leakage of clear gaseous fluids is detected for closure bolts age-managed under the Bolting Integrity program. Therefore by letter dated November 15, 2016, the staff issued RAI B.1.1-3 requesting that the applicant state how signs of leakage of clear gaseous fluids will be detected on associated closure bolting managed by

the Bolting Integrity program to ensure the detection of age-related degradation due to loss of material and loss of preload before there is a loss of intended function.

In its response dated December 15, 2016, the applicant stated that "bolted closures on fluid-containing systems would represent a sample of the overall bolted closure population, including bolted closures in gas-filled systems." The applicant stated that its review of operating experience at WF3 did not identify instances where a loss of preload of closure bolting resulted in a failure of a non-Class 1 mechanical component. The applicant stated that the Bolting Integrity program includes preventive measures, such as the selection of adequate materials and lubricants, as well as application of the appropriate preload, and checking for uniformity of gasket compression to preclude leakage, loss of material, loss of preload, and cracking. The applicant stated that leakage of clear gaseous fluids from closure bolts can be identified through visual and audible indications during system walkdown periodic inspections included in the Bolting Integrity program, routine maintenance, and operational activities. The applicant also stated the following:

> Visual indications can include residue on nearby components and, in the case of steam systems, a visible plume or condensation in the area of the leak. Audible indications that could indicate a leak are the sounds of leaking gaseous contents escaping from the system. In addition, system engineers review operations logs, deficiency lists, and system parameters such as pressure, flow, and temperature which could indicate a system leak.

The applicant concluded that based on the above activities, it can identify signs of leakage of clear gaseous fluids from closure bolts in the Bolting Integrity program and ensure that the detection of loss of material and loss of preload occurs before there is a loss of intended function. The staff notes that the GALL Report AMP XI.M18 is not a sampling-based program; instead, the program relies on periodic inspections of all closure bolts within the scope of license renewal. Based on the applicant's response statement that "fluid-containing systems would represent a sample of the overall bolted closure population, including bolted closures in gas-filled systems," it is not clear whether the applicant plans to use closure bolt degradation in fluid-filled systems as a leading indicator for degradation of closure bolting for gas-filled systems, and potentially not inspect all closure bolting as recommended by the GALL Report. The staff also noted that for systems with gaseous fluids, such as air, it is unlikely that leakage could be identified through a visual inspection and leakage would not necessarily leave residue on nearby components. The staff also notes that although identification of leakage is possible through audible indications, this method may not be effective for systems in areas where there is a high level of noise and also because of common requirements for the use of ear protection in those areas. In addition, it is not clear whether all systems with gaseous fluids are subject to a review of operations logs, deficiency lists, and parameters such as pressure, flow, and temperature that could indicate a system leak. Therefore, for each gas-filled system, it was not clear what method or combination of methods applied and how such method(s) would be effective to identify gas leakage to ensure the detection of loss of material and loss of preload before there is a loss of intended function. The staff needed further information to determine the adequacy of the program parameters for gas-filled systems. Therefore, by letter dated January 26, 2017, the staff issued RAI B.1.1-3a requesting that the applicant state whether the inspections of closure bolts under the Bolting Integrity program will include all closure bolts in scope of the program or if a sample will be inspected (inconsistent with GALL Report recommendations). The staff also requested that the applicant provide information on which systems contain gaseous fluids for which the aging effects on the closure bolts will be managed by the Bolting Integrity program, and to state how signs of leakage of clear gaseous fluids will

be detected on the associated closure bolting to ensure the detection of age-related degradation before there is a loss of intended function.

By letter dated February 23, 2017, the applicant provided an initial response to RAI B.1.1-3a. On March 28, 2017, the staff held a conference call with the applicant to seek clarification on the RAI response. During the call, the applicant stated that it will provide a revised response to RAI B.1.1-3a in an upcoming letter to the staff. By letter dated April 11, 2017, the applicant provided its revised response to RAI B.1.1-3a. In its response, the applicant stated that its Bolting Integrity program, with one exception, is a program consistent with GALL Report AMP XI.M18, "Bolting Integrity," and, as such, it will include visual inspection of all closure bolts within the scope of license renewal as described in its LRA. The applicant also stated that in addition to the visual inspections performed consistent with the GALL Report, the program will be enhanced to include visual inspection of a representative sample of closure bolts from components with an internal environment of clear gas. The sample will consist of 20 percent of the closure bolt population with up to a maximum of 25 bolts for each material and environment combination being inspected each 10-year period during the period of extended operation. The applicant also stated that the inspections will be performed when the bolting is removed to allow for the inspection of the bolting head and thread areas that are not accessible for inspection when the bolts are installed. As part of its response, the applicant revised LRA Sections A.1.1 and B.1.1 to incorporate this enhancement into its Bolting Integrity program. In its response, the applicant provided a list of the systems with their respective LRA table that have internal environments of air – indoor, air – outdoor, condensation, or gas, and credit the Bolting Integrity program for managing the effects of aging on closure bolts. The following list was provided:

Table 3.2.2-1: Containment Spray System
Table 3.2.2-2: Safety Injection System
Table 3.2.2-3: Containment Penetrations
Table 3.3.2-1: Chemical and Volume Control System
Table 3.3.2-2: Chilled Water System
Table 3.3.2-3: Component Cooling and Auxiliary Component Cooling Water System
Table 3.3.2-4: Compressed Air System
Table 3.3.2-5: Containment Cooling HVAC System
Table 3.3.2-6: Control Room HVAC System
Table 3.3.2-7: Emergency Diesel Generator System
Table 3.3.2-8: Fire Protection – Water System
Table 3.3.2-9: Fire Protection RCP Oil Collection System
Table 3.3.2-11: Nitrogen System
Table 3.3.2-12: Miscellaneous HVAC Systems
Table 3.3.2-13: Auxiliary Diesel Generator System
Table 3.3.2-14: Plant Drains
Table 3.3.2-15-3: Annulus Negative Pressure System
Table 3.3.2-15-13: Containment Atmosphere Purge System
Table 3.3.2-15-14: Containment Atmosphere Release System
Table 3.3.2-15-18: Fuel Handling Building HVAC System
Table 3.3.2-15-20: Gaseous Waste Management System
Table 3.3.2-15-22: Leak Rate Testing System
Table 3.3.2-15-24: Nitrogen System
Table 3.3.2-15-28: Primary Sampling System
Table 3.3.2-15-29: Radiation Monitoring System
Table 3.3.2-15-30: Reactor Auxiliary Building HVAC System
Table 3.3.2-15-31: Reactor Cavity Cooling System

Table 3.3.2-15-33: Secondary Sampling System,
Table 3.4.2-1: Condensate Makeup and Storage System
Table 3.4.2-5-6: Main Steam System

The applicant further stated that “[a]lthough leakage, if it occurs, may not be readily apparent from bolted closures serving some systems containing gaseous material, Waterford 3 operating experience demonstrates that the combination of preventive actions, visual inspections and observations during routine operational activities has been effective at managing the effects of aging on closure bolting.” Based on its LRA review and the applicant’s response to RAI B.1.1-3a, the staff noted that, consistent with the GALL Report AMP XI.M18, the applicant will perform visual inspections of all in-scope closure bolting under the Bolting Integrity program during periodic system walkdowns. The staff also notes that Class 1 mechanical components are managed under the applicant’s Inservice Inspection program, which is evaluated in SER Section 3.0.3.1.5; therefore, the operating experience provided on non-Class 1 components is applicable to the Bolting Integrity program. The staff reviewed the list of systems with gaseous fluids provided by the applicant and their respective LRA tables and confirmed that for each system, the applicant has assigned the AMR of the associated closure bolting to its Bolting Integrity program. The staff notes that the closure bolting for these systems will be subject to periodic visual inspections and that the applicant has enhanced its program to also perform sample-based (20 percent with a maximum of 25 bolts) visual inspections of the bolt head and threads once every 10 years. The staff notes that the sample size is consistent with the GALL Report AMP XI.M32, “One-Time Inspection,” recommendation that states that a representative sample size is 20 percent of the population or a maximum of 25 components that have the same material, environment, and aging effect combination.

The staff finds the applicant’s responses to RAIs B.1.1-3 and B.1.1-3a and its proposal to manage the aging of closure bolting on gaseous fluid systems acceptable because:

(1) The applicant clarified that with the exception (Exception 1) of submerged closure bolting, all closure bolts under the Bolting Integrity program will be subject to periodic visual inspections consistent with the GALL Report.

(2) After 32 years of operation, there is no operating experience at WF3 that indicates failure of an intended function of non-Class 1 mechanical SCs due to closure bolting degradation.

(3) Bolting in each of the gaseous systems will be addressed by multiple activities that, in combination, are capable of identifying degradation prior to loss of intended functions. These activities include (a) preventive measures (e.g., proper application of bolt preload, selection of materials, and use of lubricants) to minimize the potential of loss of preload, (b) periodic visual inspections for identifiable indications (e.g., visible plume, residue on near surfaces) of leakage of gaseous fluids, and (c) additional visual inspections of the bolt heads and threads performed once every 10 years for 20 percent of the closure bolt population with up to a maximum of 25 bolts.

The staff concerns identified in RAIs B.1.1-3 and B.1.1-3a are resolved.

Exception 1. LRA Section B.1.1, as revised by letter dated October 13, 2016, includes an exception to the “detection of aging effects” program element. In this exception, the applicant stated that it will not perform periodic inspections for leakage, loss of preload, and cracking for buried bolting in the fire water system and DCT area sump pump submerged bolting. The applicant stated that the program’s preventive measures implemented before burial

(e.g., verifying material, checking for uniform gasket compression after assembly, applying protective coating, and applying an appropriate preload) have proven effective in managing loss of preload of the buried bolting in the fire water system and that the buried bolting will be inspected consistent with the Buried and Underground Piping and Tanks Inspection program.

The staff reviewed LRA Section B.1.3, "Buried and Underground Piping and Tank Inspection," and noted that the new AMP will be consistent with the recommendations in GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," as amended by LR-ISG-2011-03, "Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program XI.M41, 'Buried and Underground Piping and Tanks.'" The staff also reviewed LRA Section B.1.13, "Fire Water System," and noted that the existing AMP will be consistent, with enhancements and exceptions, with the recommendations in GALL Report AMP XI.M27, "Fire Water System." The staff's evaluation of the Buried and Underground Piping and Tank Inspection program and Fire Water System program are documented in Sections 3.0.3.1.2 and 3.0.3.2.9, respectively. The staff noted that buried bolting in the fire water system will be managed for loss of material under the new Buried and Underground Piping and Tank Inspection program and, consistent with the program, the applicant will perform visual examinations to detect the aging effect of loss of material in buried fire water system bolting whenever the associated bolting becomes accessible. The staff also noted that consistent with the guidelines in the National Fire Protection Association Standard 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems" (NFPA 25) (2011 Edition), the existing Fire Water System program continuously monitors the required operating pressure of the fire water system and corrective actions are taken whenever loss of system pressure is detected to ensure that the system maintains its intended function.

The staff reviewed the portion of the exception regarding inspection of buried bolts against the corresponding program elements in GALL Report AMP XI.M18 and finds it acceptable because:

(1) The Bolting Integrity program has preventive measures in place that are consistent with GALL Report AMP XI.M18 to prevent loss of preload.

(2) The buried bolts will be visually inspected for the aging effect of loss material through the Buried and Underground Piping program consistent with the recommendations in GALL Report AMP XI.M41.

(3) The actions taken to prevent loss of preload, and the opportunistic inspections for loss of material in combination with the GALL Report recommended Fire Water System program, continuous monitoring of the fire water system pressure provides reasonable assurance that degradation associated with the buried bolts that may affect the system pressure (e.g., leakage) will be identified and corrective actions will be taken before there is a loss of the intended function.

However, the staff had concerns about the portion of the exception associated with the management of aging effects of the submerged closure bolts. As a result, the staff issued RAIs B.1.1-1 and B.1.1-1a. The staff discussion of its concern with the aging management of the submerged closure bolts and review of the applicant's responses to RAIs B.1.1-1 and B.1.1-1a are documented above in the staff evaluation section above.

The staff reviewed the portion of the exception regarding the inspection of the submerged closure bolts against the corresponding program elements in GALL Report AMP XI.M18 in conjunction with additional information provided by the applicant in response to RAIs B.1.1-1 and B.1.1-1a, which are resolved. The staff notes that instead of performing periodic

inspections of the submerged bolts, the applicant performs the following activities to detect and manage the effects of aging: (1) opportunistic inspection of the submerged bolting, (2) once per 7-year flow-test for each of the pumps with the associated submerged bolting, (3) once per shift inspections by the operations personnel in the sumps where the submerged bolting is located, and (4) monitoring of the sump levels in the control room with an alarm to alert operators if sumps are not maintaining acceptable levels. The staff finds the exception acceptable because the combination of the activities listed above are able to detect leakage and adequately manage the aging effects of loss of preload and loss of material in the submerged bolts prior to a loss of intended function.

Enhancement 1. LRA Section B.1.1 includes an enhancement to the "scope of program," program element. In this enhancement, the applicant stated that it will "[r]evise [the] Bolting Integrity program procedures to include submerged pressure-retaining bolting." The "scope of program" program element of GALL Report AMP XI.M18 recommends that components managed under the Bolting Integrity program be both safety-related and nonsafety-related bolting closure bolting for pressure-retaining components within the scope of license renewal. The staff reviewed this enhancement against the program element in GALL Report AMP XI.M18 and finds it acceptable because when it is implemented: (1) it will make the program consistent with the recommendations in the GALL Report AMP and (2) in combination with the activities listed in Exception 1 (above) and Enhancement 4 (below), it provides reasonable assurance that signs of leakage will be detected and the aging effects of loss of preload and loss of material will be adequately managed for the submerged bolts prior to a loss of intended function.

Enhancement 2. LRA Section B.1.1 includes an enhancement to the "parameters monitored or inspected," program element. In this enhancement, the applicant stated that it will "[r]evise [the] Bolting Integrity program procedures to monitor high-strength bolting locations (i.e., bolting with actual yield strength greater than or equal to 150 ksi) for cracking."

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 that high-strength bolting with actual yield strength greater than or equal to 150 ksi be monitored for cracking. The staff noted that the applicant also has enhanced the "detection of aging effects" (Enhancement 3) program element to perform volumetric examinations consistent with the ASME Code Section XI for closure bolting with actual yield strength greater than or equal to 150 ksi. The staff reviewed this enhancement against the program elements in GALL Report AMP XI.M18. The staff finds this enhancement acceptable because, although it may not preclude the use of high-strength bolting with actual yield strength greater than or equal to 150 ksi, the applicant will consider the actual yield strength of acquired high-strength closure bolts and, if it is equal to or greater than 150 ksi, it will monitor the high-strength closure bolts for cracking consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 3. LRA Section B.1.1 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will "revise [the] Bolting Integrity program procedures to include a volumetric examination per ASME Code Section XI, Table IWB-2500-1, for high-strength closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification." The GALL Report AMP XI.M18 "detection of aging effects" program element recommends volumetric inspections of high-strength closure bolting (actual yield strength greater than or equal to 150 ksi), in accordance with ASME Code Section XI, Table IWB-2500-1, "Examination Categories." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M18 and finds it

acceptable because when it is implemented the Bolting Integrity program will perform volumetric inspection of high-strength bolts consistent with the recommendations in GALL Report AMP XI.M18.

Enhancement 4. LRA Section B.1.1, as revised by letter dated October 13, 2016, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will "[r]evise Bolting Integrity program documents to specify opportunistic inspections of normally submerged [DCT] area sump pump discharge piping bolting."

The staff reviewed this enhancement and identified concerns regarding the management of aging effects of the submerged closure bolting, resulting in the issuance of RAIs B.1.1-1 and B.1.1-1a. The staff discussion of its concern with the aging management of the submerged closure bolts and review of the applicant's responses to RAIs B.1.1-1 and B.1.1-1a is documented above in the staff evaluation section of this AMP. Based on its review of the enhancement, in conjunction with additional information provided by the applicant in response to RAIs B.1.1-1 and B.1.1-1a, which are resolved, the staff notes that in addition to the opportunistic inspections, the applicant will also be performing (1) a once per 7-year flow-test for each of the pumps with the associated submerged bolting, (2) once per shift inspections are conducted by the operations personnel in the sumps where the submerged bolting is located, and (3) monitoring of the sump levels is carried out in the control room with an alarm to alert operators if sumps are not maintaining acceptable levels. The staff finds the enhancement to be acceptable because in combination with the activities listed above, it provides reasonable assurance that signs of leakage will be detected and the aging effects of loss of preload and loss of material will be adequately managed for the submerged bolts prior to a loss of intended function.

Enhancement 5. LRA Section B.1.1, as revised by letter dated April 17, 2017, includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will:

> [R]evise Bolting Integrity Program documents to specify visual inspection of a representative sample of closure bolting (bolt heads, nuts, and threads) from components with an internal environment of a clear gas, such as air or nitrogen. A representative sample will be 20 percent of the population (for each material/environment combination) up to a maximum of 25 fasteners during each 10-year period of the period of extended operation. The inspections will be performed when the bolting is removed to the extent that the bolting threads and bolt heads are accessible for inspections that cannot be performed during visual inspection with the threaded fastener installed.

The staff notes that the applicant added this enhancement in response to RAIs B.1.1-3 and B.1.1-3a, in which the applicant was requested to describe how it will manage the aging effects for closure bolting that are in systems with an internal environment of gaseous fluids. As documented above in the staff evaluation section, the staff finds the applicant's response to the RAIs and this associated enhancement acceptable because the proposed sample inspection in combination with the activities and operating experience described above demonstrate that the Bolting Integrity program will be capable of detecting bolting degradation before there is a loss of intended function.

Based on its audit and review of the applicant's responses to RAIs B.1.1-1, B.1.1-1a, B.1.1-3, and B.1.1-3a, 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. The staff also reviewed the exception associated with the “detection of aging effects” program element, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects. 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.1.1 summarizes operating experience related to the Bolting Integrity program. The LRA states that during visual examination performed in 2009, thread damage was discovered on two pressurizer manway studs. The applicant took corrective action by replacing the damaged studs before the manway reinstallation. The LRA also states that during visual inspections performed during 2009, the applicant detected evidence of loss of material on 18 waste gas compressor inlet isolation valve bolts. The applicant took corrective action by replacing all nuts and bolts consistent with the technical manual instructions.

The staff reviewed operating experience information in the application and during the onsite 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.

GALL Report AMP XI.M18 states that MoS_2 should not be used as a lubricant because of its potential contribution to stress corrosion cracking (SCC), especially for high-strength bolts (actual yield strength greater than or equal to 150 ksi). The GALL Report also states that the applicant should evaluate applicable operating experience to support the conclusion that the effects of aging are adequately managed. During its onsite audit, the staff confirmed that the bolting procedures had been revised to prohibit the use of MoS_2 as a lubricant for bolting; however, it was not clear whether MoS_2 lubricants have been used at WF3 before plant procedures were revised to prohibit their use. By letter dated September 15, 2016, the staff issued RAI B.1.1-2 requesting that the applicant clarify whether MoS_2 lubricants have been used on any high-strength closure bolts or any high-strength structural bolts in sizes greater than 1-inch nominal diameter within the scope of license renewal and, if so, explain how the affected bolts will be managed for age-related degradation during the period of extended operation.

In its response dated October 13, 2016, the applicant stated that based on its review of site documentation and operating experience, it determined that MoS_2 has not been used on high-strength (actual measured yield strength greater than or equal to 150 ksi) structural bolts in sizes greater than 1-inch nominal diameter or high-strength closure bolts (actual measured yield strength greater than or equal to 150 ksi) within the scope of the LRA Bolting Integrity program, Inservice Inspection-IWF program, and Structures Monitoring program.

The staff finds the applicant’s response acceptable because the applicant performed a review of site documentation and plant-specific operating experience to conclude that MoS_2 lubricants have not been used on high-strength bolts age-managed by the Bolting Integrity program, Inservice Inspection-IWF program, and Structures Monitoring program. Therefore, there is reasonable assurance that the adverse degradation effects in high-strength bolts that can be

caused by the use of MoS_2 lubricants will not be present at WF3. The staff's concern described in RAI B.1.1-2 is resolved.

Based on its audit, review of the application, and review of the applicant's response to RAI B.1.1-2, 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.M18 was evaluated.

FSAR Supplement. LRA Section A.1.1 provides the FSAR supplement for the Bolting Integrity program. The staff reviewed this FSAR 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. 1 as listed in Appendix A) to enhance the Bolting Integrity program, consistent with the description of the program enhancements in LRA Section B.1.1, before June 18, 2024. The staff finds that the information in the FSAR supplement, as amended by letters dated October 13, 2016, and April 17, 2017, is an adequate summary description of the program.

Conclusion. Based on 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 exception and its justification and determines that the AMP, with the exception, is adequate to manage the applicable aging effects. Also, 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 Coating Integrity

Summary of Technical Information in the Application. LRA Section B.1.4 describes the new Coating Integrity program as consistent, with an exception to GALL Report AMP XI.M42, "Internal Coatings/Linings for In-scope Piping, Piping Components, Heat Exchangers, and Tanks," as described 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." The LRA states that the AMP addresses coatings applied to the internal surfaces of in-scope components in an environment of raw water, treated water, lubricating oil, or fuel oil where loss of coating or lining integrity could impact the components' and downstream components' CLB intended function(s). The LRA also states that the AMP proposes to manage this aging effect through periodic visual inspections. The staff noted that the LRA Table 2s state that loss of material will also be managed for internally coated components within the scope of this 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 7 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M42. For the "scope of program" program element, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The “scope of program” program element in GALL Report AMP XI.M42 recommends that coatings are within the scope of the AMP where loss of coating or lining integrity could prevent satisfactory accomplishment of any of the components’ or downstream components’ CLB intended functions identified under 10 CFR 54.4(a)(1), (a)(2), or (a)(3). However, during its audit, the staff found that the applicant’s Coating Integrity program, as well as LRA Section A.1.4, state that coatings within the scope of the program are those that are applied to the internal surfaces of in-scope components where loss of coating or lining integrity could impact the components’ and downstream components’ CLB intended function(s). By letter dated September 15, 2016, the staff issued RAI B.1.4-1 requesting that the applicant state the basis for using the term “and” or revise the term to “or” in LRA Section B.1.4 and LRA Section A.1.4.

In its response dated October 13, 2016, the applicant revised LRA Sections B.1.4 and A.1.4 to replace the term “and” with “or.”

The staff finds the applicant’s response acceptable because the scope of the program, as revised, is consistent with AMP XI.M42. The staff’s concern described in RAI B.1.4-1 is resolved.

During its review of plant-specific operating experience, the staff reviewed a CR that documents that the internal surfaces of the fire pump diesel jacket water cooling heater might be coated. The LRA Table 2s do not cite this component. It is not clear to the staff whether this component is coated, and, if it is, how loss of coating integrity will be managed.

By letter dated September 15, 2016, the staff issued RAI B.1.4-2 requesting that the applicant state whether the internal surfaces of the fire pump diesel jacket water cooling heater are coated and, if they are coated, state how loss of coating integrity will be managed for this component.

In its response dated October 13, 2016, the applicant stated that it reviewed plant-specific documentation for the fire pump diesel jacket water cooling heater and determined that it is not internally coated. The applicant concluded that chemicals in the cooling water caused the discoloration.

The staff finds the applicant’s response acceptable because given that the heater is not internally coated, it is not within the scope of the Coating Integrity program. The staff’s concern described in RAI B.1.4-2 is resolved.

During the audit, the staff reviewed plant-specific documents that identified six internally lined tanks. These tanks were not included within the scope of the Coating Integrity program. The staff noted that all of the tanks are within the scope of license renewal because they have an intended function per 10 CFR 54.4(1)(2). Based on its review of the plant piping and instrument diagrams, the staff noted that that downstream aging effects will not occur because either coating debris would be captured by resin or resin retention elements, or pass through to other nonsafety-related components or the river. The basis for not including these tanks is as follows: (a) with the exception of the supplemental chilled water expansion tank and turbine cooling water surge tank, there are no safety-related components within the vicinity of the tanks that could be impacted should the tank leak; and (b) there are no downstream effects on safety-related equipment. During the audit, the staff reviewed a plant-specific document titled, “License Renewal Topical Report on Coating Integrity.” This document states the following:

- Essential chilled water expansion tanks are the only safety-related component located in the vicinity of the supplemental chilled water expansion tank. The supplemental chilled water expansion tank is at atmospheric pressure. The staff concluded that there is reasonable assurance that potential spray from supplemental chilled water expansion tank (due to static head) would not impact the carbon steel surfaces (reference LRA Table 3.3.2-2) of the essential chilled water expansion tanks sufficient to affect their intended function.
- Turbine cooling water surge tank is located in the component cooling water (CCW) surge tank room with the safety-related CCW surge tank. The turbine cooling water surge tank is at atmospheric pressure. The staff reviewed drawing 1564-3279 and confirmed that the tank is approximately 7 ft. tall. A 7-ft. head of water would result in no more than approximately 3 psi of pressure if a hole developed in the bottom of the tank. The staff concluded that there is reasonable assurance that the water spray from a 7-ft head of water would not damage any nearby safety-related equipment because of the very low pressure at the exit of the potential hole.

The staff finds that the six internally coated tanks in the document cited above need not be within the scope of the Coating Integrity program because there is reasonable assurance that loss of coating integrity for these tanks would not affect a safety-related component within the vicinity of the tanks and there are no downstream effects on safety-related equipment.

The staff also reviewed the portions of the "detection of aging effects" program element associated with an exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception 1. LRA Section B.1.4 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that the Coating Integrity "program will provide a one-time inspection of the internal coating for the 11-ft. diameter carbon steel circulating water piping." The applicant stated that the in-scope function of this pipe that is normally in service is to provide a source of water to refill the wet cooling tower basin in the unlikely event that the basin is emptied by a tornado. The applicant further stated that the basis for conducting a one-time inspection in lieu of periodic inspections is: (a) if a large enough piece of the coating material became detached during normal operation, the circulating water flow would transport the coating to the condenser water box where it would be detected in the control room by a change in temperature across the affected water box and decrease in condenser vacuum; (b) the water boxes are periodically cleaned (approximately once per year), during which time degraded coatings transported to the waterbox would be detected; (c) a review of plant-specific operating experience did not reveal any record of degraded circulating water pipe coating plugging condenser tubes; (d) during a tornado event, it is assumed that there is a loss of offsite power resulting in loss of the circulating water pumps and a lower flow in the pipe; (e) the lower flow, as well as the coating having a higher specific gravity than water, would result in detached coatings settling to the bottom of the 11-ft. pipe; and (f) the 16-inch supply line to the wet cooling tower basin takes suction from the 11-ft. pipe 5.5 ft. above the bottom of the 11-ft. pipe. The applicant stated that the one-time inspection would: (a) be conducted 10 years prior to the period of extended operation; (b) be conducted on 50 percent of the total length of the pipe segment; and (c) the acceptance criteria and corrective actions will be consistent with the recommendations in AMP XI.M42. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M42 and finds it acceptable, in part, because the plant configuration minimizes the potential for transport of substantial coating debris sufficient to obstruct flow in the in-scope portion of the system while it

is performing its intended function. The basis for this is: (a) the flow velocity in the coated piping is substantially higher during normal operation than when the in-scope intended function is performed; (b) during normal operation, the effect of large coating debris transporting to the condenser tube sheet is detectable in the control room; and (c) during the lower flow conditions, coating debris should settle below the inlet to the supply line to the wet cooling tower basin. However, the exception does not specifically state what actions will be taken in future inspections if the one-time inspection does not meet acceptance criteria. By letter dated September 15, 2016, the staff issued RAI B.1.4-3 requesting that the applicant state whether periodic inspections of the internal coatings of the 11-ft. diameter circulating water piping will be subsequently conducted if the one-time inspection results do not meet acceptance criteria.

In its response dated October 13, 2016, the applicant revised LRA Sections B.1.4 and A.1.4 to require that periodic inspections will be conducted if the one-time inspections do not meet acceptance criteria. The applicant also revised LRA Section B.1.4 to state that the periodic inspections will be conducted in accordance with the frequency cited in LR-ISG-2013-01, Appendix C (i.e., AMP XI.M42), Table 4a, and the cited extent of inspections are consistent with AMP XI.M42.

The staff finds the applicant's response acceptable because:

- Given the low potential for loose coating debris to affect the intended function of the piping used to refill the wet cooling tower basin, a one-time visual inspection consistent with AMP XI.M42 conducted after 30 years of operation coupled with normal inspections of the condenser water boxes for debris provides reasonable assurance that the intended function of the piping will be met as long as the coatings meet the acceptance criteria of AMP XI.M42.
- The Coating Integrity program, as revised, will require periodic inspections consistent with AMP XI.M42 if the coatings do not meet acceptance criteria.

The staff's concern described in RAI B.1.4-3 is resolved.

Based on its audit, and review of the applicant's responses to RAI B.1.4-1, RAI B.1.4-2, and RAI B.1.4-3, the staff finds that program elements 1 through 7 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M42. The staff also reviewed the exception associated with the "detection of aging effects" program element, and its justification, and finds that the AMP, with the exception, is adequate to manage the applicable aging effects.

<u>Operating Experience</u>. LRA Section B.1.4 summarizes operating experience related to the Coating Integrity program. The applicant stated that the Coating Integrity program is a new program and plant operating experience will be obtained as it is implemented. The staff noted that AMP XI.M42, the basis for the Coating Integrity program, was based on 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. In addition, the staff finds that the conditions and operating experience at the plant are bounded by those for which GALL Report AMP XI.M42 was evaluated.

FSAR Supplement. LRA Section A.1.4, as amended by letter dated October 13, 2016, provides the FSAR supplement for the Coating Integrity program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1 in LR-ISG-2013-01.

The staff also noted that the applicant committed to implement the new Coating Integrity program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later, for managing the effects of aging for applicable components (commitment no. 3 as listed in Appendix A).

The staff finds that the information in the FSAR supplement, as amended by letter dated October 13, 2016, is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Coating 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 exception and its justification 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 Compressed Air Monitoring

Summary of Technical Information in the Application. LRA Section B.1.5 describes the existing Compressed Air Monitoring program as consistent, with enhancements, with GALL Report AMP XI.M24 "Compressed Air Monitoring." The LRA states that the AMP manages loss of material in compressed air systems by periodically monitoring the air for moisture and contaminants and inspecting system internal surfaces. The LRA also states that air quality is maintained in accordance with limits based on consideration of manufacturer recommendations and industry guidelines. The LRA further states that air quality parameters are trended to determine if limits are approached or exceeded.

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 "scope of program," "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.1.5 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the Compressed Air Monitoring program procedures will be revised to include the emergency diesel generator (EDG) starting air system. 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.1.5 includes an enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that the Compressed Air Monitoring program procedures will be revised to apply consideration of the guidance of ASME OM-S/G-1998 (Part 17) Performance Testing of Instrument Air Systems in Light-Water Reactor Power Plants, EPRI NP-7079 Instrument Air Systems – A Guide for Power Plant Maintenance Personnel, and EPRI TR-108147 Compressor and Instrument Air System Maintenance Guide to the limits specified for the air system contaminants. 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. The three aforementioned industry guidance documents, along with ANSI/ISA-S7.0.01-1996 Quality Standard for Instrument Air, are cited in the GALL Report as guidance for maintaining air quality for the compressed air systems. WF3 currently only references the limits in ANSI/ISA-S7.0.01-1996 in to maintain its instrument air quality (Ref: CE-002–032 Maintaining Instrument Air System, Revision 305, effective date: November 3, 2014). Inclusion of the other three guidance documents will align the WF3 Compressed Air Monitoring program with the GALL Report. 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.1.5 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 Compressed Air Monitoring program procedures will be revised to include periodic and opportunistic visual inspections of accessible internal surfaces of system components, including accumulators, flex hoses, and tubing at the frequencies recommended by ASME OM-S/G-1998 (Part 17). 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 “scope of program,” “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.1.5 summarizes operating experience related to the Compressed Air Monitoring program. In 2014, site personnel discovered a small leak on the Emergency Diesel Generator A starting air system tube fitting. The system was later repaired as noted in CR-WF3-2014-01061. The applicant described that in 2014, site personnel reviewed site procedures and concluded that the site procedures had incorporated the most current instrument air quality standards in ANSI/ISA-S7.0.01-1996. In addition, a small air leak was discovered on an instrument air supply line to a main feedwater regulating valve in 2013. The cause of the leak was attributed to either vibration or maintenance work in the vicinity of the leak. The leak was repaired and the component was returned to operational status.

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.

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.M24 was evaluated.

FSAR Supplement. LRA Section A.1.5 provides the FSAR supplement for the Compressed Air Monitoring program. The staff reviewed this FSAR 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 (commitment no. 4 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on 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. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Containment Inservice Inspection – IWE

Summary of Technical Information in the Application. LRA Section B.1.6 describes the existing Containment Inservice Inspection – IWE (CII-IWE) as consistent, with an enhancement, with GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE." The LRA describes the WF3 containment as a free-standing SCV consisting of a vertical upright cylinder with a hemispherical dome, and an ellipsoidal bottom encased in concrete and founded on the common concrete foundation with the Shield Building. The LRA states that the AMP addresses steel, stainless steel, and elastomer materials of the SCV and its integral attachments, containment equipment hatches, airlocks, moisture barriers, and pressure-retaining bolting exposed to air indoor, uncontrolled environment, to assess the general condition and detect evidence of degradation, and manage the aging effects of loss of material, loss of leak tightness, loss of preload, and loss of sealing. The LRA also states that the AMP proposes to manage these aging effects through periodic visual examinations (general visual, VT-1, and VT-3) implementing the requirements of the ASME Code Section XI, Subsection IWE, and 10 CFR 50.55a, and preventive provisions to ensure appropriate selection of bolting material, installation torque or tension, and appropriate use of lubricants and sealants. The program includes acceptance criteria, and provisions for expansion of inspection scope and corrective actions when identified degradation exceeds acceptance criteria.

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 "preventive actions" 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 "preventive action" program element in GALL Report AMP XI.S1 states, in part: "The program is also augmented to require that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG–1339 to prevent or mitigate degradation and failure of structural bolting." However, during its audit, the staff found that the corresponding section of the applicant's Aging Management Program Evaluation Report (AMPER) for LRA AMP B.1.6 states, in part:

> The program is a condition monitoring program and does not include guidance for the selection of bolting material, installation torque or tension, and use of lubricants and sealants. The program is supplemented by existing plant procedures to ensure that the selection of bolting material installation torque or tension, and the use of lubricants and sealants is appropriate for the intended purpose. These procedures use the guidance contained in NUREG–1339 and in EPRI NP-5769, NP-5067, and TR-104213 to ensure proper specification of bolting material, lubricant, and installation torque.

It was not clear to the staff if the above statements in the "preventive actions" program element are consistent because (1) it appears to be an enhancement to an existing code-based condition monitoring (only) program, and (2) the staff was unable to identify a link between the AMP implementing procedure(s) and the existing supplemental procedure(s) being credited. By letter dated September 15, 2016, the staff issued RAI B.1.6-1 requesting that the applicant clarify how the "preventive action" program element in LRA AMP B.1.6 is consistent with the GALL Report AMP XI.S1 with regard to supplemental preventive actions for selection of bolting material installation torque or tension and the use of lubricants and sealants in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG–1339 to prevent or mitigate degradation and failure of structural bolting.

In its response to RAI B.1.6-1 dated October 13, 2016, the applicant stated that the WF3 AMP in LRA Section B.1.6 uses existing implementing procedures based on the guidance contained in NUREG–1339 and in EPRI Report NP-5769, NP-5067, and TR-104213 to ensure appropriate specification of bolting material, lubricants and sealants, and installation torque or installation. The applicant also stated that preventive actions for lubricants and SCC potential are already included in WF3 plant procedures that provide guidance for the selection of bolting material, the selection of installation torque or tension, and use of lubricants and sealants, and no additional enhancement is necessary. The applicant further clarified that appropriate sections of the program evaluation report for LRA AMP B.1.6 have been revised to indicate that the program included existing guidance for the selection of bolting material, installation torque or tension, and use of lubricants and sealants consistent with the GALL Report discussion related to high-strength bolting.

The staff finds the applicant's response acceptable because it confirmed consistency of the "preventive actions" program element of LRA AMP B.1.6 with the GALL Report AMP XI.S1

regarding the selection of bolting material, installation torque or tension, and the use of lubricants and sealants to prevent or mitigate structural bolting degradation and failure without the need for any additional enhancement by (1) clarifying that the program already uses existing implementing procedures that use the guidance contained in NUREG–1339, and in EPRI Report NP 5769, NP 5067, and TR 104213 to accomplish this, and (2) revising applicable sections of the AMPER report to indicate the link between the program and these existing implementing procedures for the above-mentioned preventive actions. The staff's concern described in RAI B.1.6-1 is resolved.

The "preventive action" program element of GALL Report AMP XI.S1 states, in part: "If the structural bolting consists of ASTM A325, ASTM F1852, and/or ASTM A490 bolts, the preventive actions for storage, lubricants, and stress corrosion cracking (SCC) potential discussed in Section 2 of RCSC (Research Council for Structural Connections [RCSC]) publication 'Specification for Structural Joints Using ASTM A325 or A490 Bolts,' need to be considered." However, during its audit, the staff noted that the enhancement to the "preventive actions" program element of LRA AMP B.1.6 and its AMPER document, intended to achieve consistency with the GALL Report AMP states: "Revise plant procedures to include the preventive actions for storage of ASTM A325, ASTM F1852 and A490 bolting from Section 2 of Research Council for Structural Connections publication, 'Specification for Structural Joints Using ASTM A325 or A490 Bolts.'" The staff noted that the applicant excluded the use of preventive actions for lubricants, and SCC potential by stating that a review of Section 2 of the RCSC publication concluded that the publication only addressed storage and does not address the preventive actions for lubricants and SCC potential for these bolts.

It was not clear to the staff if the above statements are consistent, because the LRA AMP enhancement description does not include the RCSC Section 2 recommended preventive actions for lubricants and SCC potential. By letter dated September 15, 2016, the staff issued RAI B.1.6-2 requesting that the applicant clarify how the above-described enhancement in the "preventive action" program element in LRA AMP B.1.6 is adequate to establish consistency with the GALL Report AMP XI.S1 with regard to preventive actions for lubricants and SCC potential of ASTM A325, ASTM F1852, and/or ASTM A490 bolts.

In its response to RAI B.1.6-2 dated October 13, 2016, the applicant stated that the WF3 AMP in LRA Section B.1.6 uses (existing) implementing procedures based on the guidance contained in NUREG–1339, and in EPRI Report NP-5769, NP-5067, and TR-104213, to ensure proper specification of bolting material, lubricants and sealants, and installation torque or installation appropriate for the intended purpose. The applicant also stated that preventive actions for lubricants and SCC potential are already included in WF3 plant procedures that provide guidance for the selection of bolting material, the selection of installation torque or tension, and use of lubricants and sealants, and no additional enhancement is necessary for these preventive actions. The applicant clarified, however, that storage recommendations discussed in Section 2 of the RCSC publication for the mentioned high-strength bolts are not addressed in plant procedures; therefore, the LRA includes an enhancement to revise plant procedures to include the RCSC recommendations for storage to be consistent with the GALL Report. The applicant further clarified that appropriate sections of the program evaluation report for LRA AMP B.1.6 have been revised to more clearly identify the GALL Report recommendations that are already included in the program implementing procedures.

The staff finds the applicant's response acceptable because it addressed the adequacy of the existing LRA enhancement to establish consistency of the "preventive actions" program element of LRA AMP B.1.6 with the GALL Report AMP XI.S1, with regard to storage, lubricants, and

SCC potential of ASTM A325, ASTM F1852, and/or ASTM A490 structural bolts without the need for a revised enhancement to address these based on the RCSC specification by (1) considering the RCSC publication preventive actions for lubricants and SCC potential, and clarifying that the program already uses existing implementing procedures that use the guidance contained in NUREG–1339, and in EPRI Report NP-5769, NP-5067, and TR-104213, to accomplish this for all structural bolting, including ASTM A325, ASTM F1852, and/or ASTM A490 bolts, thereby meeting the intent of the GALL Report recommendation with regard to lubricants and SCC potential; therefore, the program enhancement needed only to address the storage aspect for these bolts; and (2) revising applicable sections of the AMPER report to clearly identify the GALL Report recommendations that are already included (i.e., preventive actions for lubricants and SCC potential) in the program implementing procedures. The staff's concern described in RAI B.1.6-2 is resolved.

The "detection of aging effects" program element of the GALL Report AMP X1.S1 recommends that the program be augmented to require surface examination, in addition to visual examination, to detect cracking in stainless steel penetration sleeves, bellows, dissimilar metal welds, and steel components that are subject to cyclic loading but have no CLB fatigue analysis. The GALL Report AMP also states that, where feasible, appropriate Appendix J tests may be performed in lieu of surface examination. However, during its audit, the staff noted that the corresponding program element in the LRA AMPER document states:

> Stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading but have no current licensing basis fatigue analysis are monitored for cracking. Additionally, AMP X1.S4 Containment Leak Rate Program (10 CFR Part 50, Appendix J) tests may be performed in lieu of surface examination.

Noting that visual examination may not detect fine cracks that could occur as a result of cyclic loading, and that the LRA AMP did not identify any enhancement to supplement the existing program and implementing procedures with the enhanced examination method capable of detecting cracking, it was not clear to the staff that these statements are consistent for the following reasons: (1) the LRA AMP and implementing procedures do not clearly reflect whether surface examinations will be conducted to detect cracking due to cyclic loading, or if Appendix J testing will be performed or credited instead; nor does it identify the specific components to which each detection method will be applied; and (2) if Appendix J testing will be performed, the LRA does not specify the type of test or explain why the test is appropriate for timely detection of cracking.

By letter dated September 15, 2016, the staff issued RAI B.1.6-3 requesting that the applicant: (1) state whether the supplemental surface examination recommended in GALL Report AMP X1.S1 will or will not be performed, to detect cracking in stainless steel penetration sleeves, bellows, dissimilar metal welds, and other steel containment pressure-retaining boundary components that are subject to cyclic loading but have no CLB fatigue analysis. If supplemental surface examination will be performed, the applicant was asked to identify the components and indicate what standard will be used to perform surface examination of these components, and explain how it is captured in the LRA AMP without an enhancement; (2) if an Appendix J test is used to detect cracking in lieu of supplemental surface examination, the applicant was asked to identify the applicable components and indicate the type of Appendix J test that will be used for these applicable components and provide information to justify its appropriateness for timely detection of cracking prior to loss of intended function; and (3) if supplemental examination will not be performed or supplemental examination methods other

than that described in GALL Report AMP XI.S1 will be used for any of the components listed, the applicant was asked to describe and justify the exception to the GALL Report AMP XI.S1 with regard to adequate capability of the LRA AMP to detect cracking due to fatigue damage from cyclic loading consistent with the criteria of 10 CFR 54.21(a)(3).

In its response dated October 13, 2016, and revised by letter dated January 19, 2017, to the first part of RAI B.1.6-3, the applicant stated that stainless steel penetration bellows have an analysis considered a CLB fatigue analysis as indicated in LRA Table 3.5.2-1 and described in LRA Section 4.6. The applicant further stated that the WF3 containment penetration sleeves are equipped with bellows to accommodate movement of the penetration piping and sleeves due to thermal expansion, and minimizes loading on the penetration sleeves; therefore, there are no stainless steel penetration sleeves subject to cyclic loading associated with the SCV. The applicant further stated that dissimilar metal welds associated with the stainless steel bellows are also not subject to cyclic loading and not analyzed for cyclic loading. The applicant also stated that no other (stainless) steel components were identified that are associated with containment penetrations and that are subject to cyclic loading. The applicant thus concluded that supplemental surface examination recommended in the GALL Report AMP XI.S1 for the stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading does not apply at WF3. The applicant further stated that the discussion provided in the “detection of aging effects” program element in LRA Section 3.2.B.4.b, AMPER document (WF3 EP 14 00008, Revision 1), regarding related components with no CLB fatigue analysis is incorrect and has been revised to be consistent with this RAI response. The applicant reiterated in this regard that, as stated in LRA Section B.1.6, the CII-IWE, with enhancement, will be consistent with GALL Report AMP XI.S1 because no stainless steel components without a CLB fatigue analysis that are subject to cyclic loading have been identified at WF3.

In its response dated January 19, 2017, to the second and third parts of RAI B.1.6-3, the applicant stated that a CLB fatigue analysis does exist for the only WF3 stainless steel components that are subject to cyclic loading; namely, penetration bellows, and, therefore supplemental surface examination as described in the “detection of aging effects” program element of GALL Report AMP XI.S1 is not applicable. The applicant concluded that WF3’s CII IWE program with the stated enhancement in LRA Section B.1.6 will be consistent with the GALL Report program.

The staff notes that, for pressurized water reactor (PWR) steel containments, the provision related to supplemental surface examination in the “detection of aging effects” program element of GALL Report AMP XI.S1 is intended to address SRP-LR Table 3.5.1, item 27, and the corresponding GALL Report AMR item II.A3.CP 37. This GALL Report AMR item manages cracking due to cyclic loading for stainless steel, dissimilar metal welds, and steel components of penetration sleeves and penetration bellows that are subject to cyclic loading but have no CLB fatigue analysis. The staff also noted that the applicant’s revision to LRA Table 3.5.1, item 3.5.1-27, in its response dated December 7, 2016, to RAI 3.5.2.2.1.5-1 related to aging management of penetration sleeves for cracking due cyclic loading, states: “WF3 penetration sleeves are not subject to cyclic loading. Penetration sleeves are equipped with bellows which minimizes loads on these components; therefore, this aging effect does not require management. Nevertheless, applicable penetration components are included in the Containment Inservice Inspection – IWE and Containment Leak Rate Programs.” This indicates that the components of the containment penetrations with stainless steel bellows (sleeves, bellows, and associated dissimilar metal welds) are subject to local leak rate testing (Type B) under the 10 CFR Part 50, Appendix J containment leak rate testing program. Additionally, as

documented in the Audit Report, during the audit, the staff reviewed Section 3.2.A.b of the AMPER document for the CII-IWE program and Memo W3F 1-92-0473, "Information Notice No. 92-20 Inadequate Local Leak Rate Testing," and noted that the technical evaluation documentation of IN 92-20 for applicability, concluded that a valid Type B LLRT of the WF3 containment penetration bellows could be performed in accordance with the requirements of 10 CFR Part 50 Appendix J; therefore, the IN recommendation for augmented inspection of the bellows does not apply to the WF3 program.

The staff finds the applicant's response to RAI B.1.6-3, and its conclusion that the supplemental surface examination provision of GALL Report AMP XI.S1 to manage cracking due to cyclic loading in stainless steel penetration sleeves, bellows, and dissimilar metal welds with no CLB fatigue analysis is not applicable to WF3, acceptable because: (1) the WF3 penetration sleeves are equipped with bellows that accommodate movement and minimize loading on the sleeves, and, therefore, WF3 penetration sleeves and associated dissimilar metal welds are subject to minimal cyclic loading; (2) the stainless steel penetration bellows that are subject to cyclic loading at WF3 have a CLB fatigue analysis TLAA described in LRA Section 4.6, the staff evaluation for which is documented in SER Section 4.6; (3) the WF3 containment penetration bellows and associated dissimilar metal welds are nevertheless subject to Type B LLRTs that can detect degradation in addition to visual examination; and (4) the applicant indicated it revised the LRA AMPER document for CII-IWE to correct the discrepant statements in this regard to be consistent with the RAI response. The staff's concern described in RAI B.1.6-3 is resolved.

The staff also reviewed the portions of the "preventive actions" 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.1.6, as clarified by letter dated October 13, 2016, in response to RAI B.1.6-2, includes an enhancement to the "preventive actions" program element. In this enhancement (LR commitment no. 5), the applicant stated that prior to the period of extended operation, plant procedures will be revised to include the preventive actions for storage of ASTM A325, ASTM F1852 and A490 bolting from Section 2 of RCSC publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts." The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S1 and finds it acceptable because when it is implemented it will provide guidance for "preventive actions" to prevent or mitigate degradation and failure (to ensure integrity) of ASTM A325, ASTM F1852, and/or ASTM A490 structural bolting, which is consistent with the recommendations of GALL Report AMP XI.S1.

Based on its audit, and review of the applicant's responses to RAIs B.1.6-1, B.1.6-2, and B.1.6-3, the staff finds that program elements 1 through 6 for which the applicant claimed consistency with the GALL Report, as applicable to WF3, are consistent with the corresponding program elements of GALL Report AMP XI.S1. In addition, the staff reviewed the enhancement associated with the "preventive actions" program element and finds that when implemented, it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.6 summarizes operating experience related to the Containment Inservice Inspection - IWE AMP. The applicant described examples of plant-specific operating experience and the process for review of current and future plant-specific and industry operating experience, to provide objective evidence that the CII-IWE program is effective in detecting aging effects and taking appropriate corrective actions to

address observed conditions, such that intended functions are maintained consistent with the CLB through the period of extended operation. Two illustrative examples in the LRA are described below.

A general visual examination of the interior surface of the containment vessel conducted during the 2003 refueling outage in accordance with the requirements of ASME Code Section XI, Subsection IWE, identified conditions on the surface of the containment vessel that did not meet the screening criteria of the CII-IWE program. However, these conditions were determined to not jeopardize the structural integrity or leak-tightness of the containment. The majority of the conditions noted were uncoated surfaces, coating blisters greater than size No. 6 as specified in ASTM D174, and excessive wear defined as wear that results in removal of the coating material to expose bare metal. Also, one gouge 0.078-inches deep and coated was identified. There was no change in the gouge's shape or size since being identified previously in the fall refueling outage of 2000. The gouge depth is less than 10 percent of the bare metal thickness (2 inches) and within code allowable flaw size. Other areas of the containment vessel identified during the 2003 refueling outage with paint that was flaking, peeling, blistering, or exhibiting discoloration required a VT-3 examination. CRs were issued to document the details and results of the VT-3 examinations of the areas with degraded coating.

During a VT-3 inspection performed in 2008, of the containment inner moisture barrier (located between the containment vessel and the concrete floor on the ledge on elevation -4 ft.), six degraded locations were noted that required repair of the moisture barrier. The observed degradation was due to the effects of aging and mechanical damage to the moisture barrier. None of the affected areas showed signs of wetting, and no corrosion of the containment vessel was noted. The damaged portions of the moisture barrier were removed and replaced with new sealant. A CR was initiated to track and trend the findings of the examinations. All examination findings were satisfactory.

The applicant also summarized its review of IN 2010-12, "Containment Liner Corrosion," for applicability to the WF3 free-standing SCV with regard to the potential for corrosion in locations that are primarily unique to concrete containments with steel liner plates in direct contact with concrete. The applicant noted that the only portion of the WF3 SCV in contact with concrete is the embedded bottom of the vessel.

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 plant-specific operating experience involving corrosion indications of the SCV, for which it determined the need for additional clarification and resulted in the issuance of an RAI, as discussed below.

During the audit, the staff reviewed CR-WF3-2000-01375, dated October 28, 2000, which documented corrective actions to address plant-specific operating experience of corrosion, with flaking noted on the SCV to a depth of at least 18 inches below the surface of the outer moisture barrier in the annulus region, and that appeared to exist around the entire knuckle region of the containment vessel within the annulus. The CR noted that the corrosion was apparently from initial construction, was determined to be non-active, and ultrasonic wall thickness measurements showed that the containment vessel wall thickness exceeded the design thickness of 2.1875 inches. Because chemical analysis of scale samples indicated the

presence of chlorides and sulfides, there could be the potential that the non-active corrosion of the SCV in the knuckle area may be reactivated by moisture and potentially impact containment vessel intended function prior to or during the period of extended operation. The staff also noted that during refueling outage 18, a construction opening for SG replacement was made in the Shield Building by hydrodemolition, which could have resulted in intrusion of water into the annulus moisture barrier areas. The staff needed additional information to determine the need to verify, prior to entering the period of extended operation, that the observed corrosion continues to remain non-active and whether the applicant's plant-specific operating experience supports the sufficiency of the LRA AMP.

By letter dated September 15, 2016, the staff issued RAI B.1.6-4 requesting that the applicant: (1) summarize the plant-specific operating experience of corrosion around the entire circumference of SCV in the knuckle region below the annulus moisture barrier documented in CR WF3 2000-01375, its cause and actions taken to address it; and (2) explain, with technical detail, any enhancement that may be made to the LRA AMP to verify, prior to entering the period of extended operation, that the observed corrosion in this operating experience in the knuckle region continues to remain non-active; or, alternatively, explain why such an enhancement is not necessary for the LRA AMP to meet the criteria of 10 CFR 54.21(a)(3).

In its response dated October 13, 2016, to the first part of RAI B.1.6-4, the applicant detailed the plant-specific operating experience stating that the October 2000 CII-IWE inspection identified corrosion of the SCV in the knuckle region below the annulus moisture barrier, following which a CR was written consistent with the WF3 corrective action program, and corrective actions were initiated. Visual examinations of the SCV, performed during the same period, as part of the corrective actions outlined in the CR, revealed corrosion of a greater extent than anticipated. Corrosion was noted on the SCV to a depth of at least 18 inches below the top surface of the moisture barrier where the barrier was removed, and this condition existed around the entire knuckle region of the SCV within the annulus. The applicant stated that its evaluation concluded that the condition did not affect the containment structural integrity or its leak-tightness, and was supported by the NDE, which showed that all examined locations exceed the design wall thickness of 2.1875 inches. The applicant further stated that a nonconformance report (NCR) during original construction indicates that the original plates installed in the knuckle region were corroded with slight pitting and that all the examined sections of the plates had a material thickness greater than 2.1875 inches. The applicant explained that while corrosion and scale were noted to a degree consistent with original construction data, the UT thickness measurements showed that the SCV wall thickness remains above the design thickness of 2.1875 inches. The applicant concluded that, specifically, the conditions noted during the October 2000 CII-IWE inspections were consistent with the conditions noted during initial construction, confirming that the corrosion has not progressed and remains non-active. Additionally, the corrosion involved flaking and the area behind the flakes exhibited signs of general corrosion; however, for active corrosion mechanisms, bright metal would be expected behind flaking. No moisture was noted within the annulus, including the area where the moisture barrier was removed, and the results of these (2000) inspections confirmed no active corrosion.

The applicant also stated that, in October 2012 (steam generator replacement refueling outage 18), inspections were performed of the SCV surface and the moisture barrier inside the annulus from azimuth 0° to 138° with satisfactory results. During SG replacement activities, hydro-blasting was performed, resulting in standing water over the moisture barrier between the 30° and 70° azimuth locations. Therefore, three 18 inches x 18 inches moisture barrier sections were removed in this area and the liner was examined at azimuth 30°, 42°, and 70° locations

with no active degradation noted. After replacement of these sections of the moisture barrier, an examination of the repaired moisture barrier areas was performed with satisfactory results.

The applicant further stated that the apparent cause of the corrosion of the SCV below the moisture barrier in the annulus was determined to be installation of corroded plates during original construction. The corrective actions to address the issue included the following: (a) the moisture barrier was repaired and reexamined, (b) the site inspection procedure was revised to specify increased examination frequency for the moisture barrier, and (c) the concrete in the vicinity of the annulus moisture barrier was inspected and documented satisfactory results. Further, it was determined that due to the porous nature of the (moisture barrier) materials, additional steps were necessary to ensure that the corrosion remains inactive. Those potential steps were: (1) regular monitoring of the containment SCV surfaces covered by the barrier material, (2) removal of the corrosion products and coating the affected surfaces with an approved coating system prior to reinstallation of the barrier material, and (3) removal of the corrosion products and replacement of the barrier material with a non-deleterious material impervious to water. A procedure change was initiated to ensure monitoring of the external (annulus side) moisture barrier and the associated SCV surfaces until such time as either option 2 or 3 were performed. This change required supplementary examinations to ensure that the corrosion remains inactive by examining both disturbed areas of the SCV (previously inspected and recoated), and undisturbed sections of the moisture barrier each refueling outage. These supplementary examinations were performed as specified by the responsible engineer. Since accelerated corrosion was not likely as long as the areas remained dry and all measured SCV thicknesses were above the specified design thickness, Code-required IWE augmented examinations were not applied.

In its response dated October 13, 2016, to the second part of RAI B.1.6-4, the applicant stated that the observed corrosion in the knuckle region identified during CII-IWE inspections in October 2000, remains inactive based on corrective actions taken, and continued periodic examination of the SCV and moisture barrier in accordance with Table IWE 2500 1, "Examination Category E-A of the ASME Code," Section XI, Subsection IWE. CRs were written to assess and evaluate the degradation of the moisture barrier in fall 2000. In addition to the requirements of ASME Code Section XI, Table IWE-2500-1, owner-elected examinations were performed every outage from October 2000 through October 2009. Since the degradation remained essentially unchanged, these areas were determined to no longer need the supplemental examinations in accordance with IWE-2420(c). In 2012, inspections were performed on selected areas of the SCV where the moisture barrier was removed, and the SCV visually examined at three locations between azimuth 30° and 70° for evidence of cracking, discoloration, wear, pitting, excessive corrosion, arc strikes, gouges, surface discontinuities, dents, bulges, or other surface irregularities. The results indicated no evidence of degradation that may affect structural integrity or leak tightness was identified. Also, during these inspections, no evidence of active degradation or relevant conditions of the SCV liner were identified that would warrant additional inspections. Subsequent inspections since then also have not identified degradation related to moisture barriers. The applicant concluded that the observed corrosion of the SCV in the knuckle region has been appropriately addressed as part of WF3's corrective action program. The continued examination of the SCV and moisture barrier as part of the WF3 CII-IWE AMP, in accordance with ASME Code Section XI, Subsection IWE, will ensure that they continue to perform their intended functions through the period of extended operation, and therefore, no additional enhancement to LRA AMP Section B.I.6 is necessary.

From the audit and the applicant's above RAI response, the staff noted that following UT measurements and determination that the condition was consistent with that documented from original construction (from exposure to weather) and that the corrosion mechanism was not active, the surface areas with corrosion noted in 2000, in the annulus moisture barrier area, was accepted by examination. The staff finds the applicant's response to the first part of RAI B.1.6-4 acceptable because the applicant provided a detailed summary of the plant-specific operating experience of corrosion observed in the knuckle region of the SCV below the annulus moisture barrier, its apparent cause (from initial construction), and actions taken in its corrective action program to address the condition and determine that the corrosion was inactive. The staff finds the applicant's response to the second part of RAI B.1.6-4 acceptable because (1) the applicant appropriately addressed the observed corrosion found in 2000, in the annulus knuckle region of the SCV, in its corrective action program and demonstrated effective implementation of its CII-IWE program; this was accomplished through a series of actions, including UT examinations of the SCV that showed thickness greater than design thickness, and subsequent supplemental examinations and re-examinations of the moisture barrier and SCV in the affected areas that demonstrated that the observed corrosion continues to remain inactive, and effective implementation of its CII-IWE program; and (2) additionally, the applicant's continued effective examination of the SCV, including moisture barrier as part of WF3's CII-IWE AMP in accordance with ASME Code Section XI, Subsection IWE, provides reasonable assurance that the effects of aging of the SCV will be adequately managed such that the SCV will continue to perform its intended functions through the period of extended operation, and therefore, no additional enhancement to LRA AMP Section B.I.6 is necessary. The staff's concerns described in RAI B.1.6-4 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.1.6-4, 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.S1 was evaluated.

FSAR Supplement. LRA Section A.1.6 provides the FSAR supplement for the Containment Inservice Inspection – IWE AMP. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1 and noted that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP.

The staff found that information in the FSAR supplement did not appear to provide an adequate summary description of the LRA AMP B.1.6 because (1) it does not sufficiently define what the LRA AMP covers in terms of components, materials, environments, aging effects, and key condition monitoring actions; rather, a significant part of the supplement primarily repeats the structural configuration description of the SCV that is already in FSAR Section 3.8.2, and (2) the description does not provide information consistent with that for AMP XI.S1 in SRP-LR Table 3.0-1. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information into its FSAR supplement.

In order to obtain the information necessary to verify the sufficiency of the FSAR supplement program description, by letter dated September 15, 2016, the staff issued RAI A.1.6-1 requesting that the applicant clarify how the FSAR supplement in LRA Section A.1.6 adequately defines the LRA AMP B.1.6 in terms of components, materials, environments, aging effects, and key condition monitoring actions; or, provide a revised FSAR supplement description for LRA

Section A.1.6 to also include information, equivalent to that in SRP-LR Table 3.0-1 for GALL Report AMP XI.S1, that sufficiently defines the LRA AMP in terms of components, materials, environments, aging effects, and key condition monitoring actions.

In its response dated October 13, 2016, the applicant stated that LRA Section A.1.6 is revised to include information equivalent to that in SRP-LR Table 3.0-1 for GALL Report AMP XI.S1, and included the revised FSAR supplement in the response.

The staff finds the applicant's response acceptable because the revised LRA Section A.1.6 provided an adequate description addressing the issues raised by the staff and is equivalent with that for AMP XI.S1 in SRP-LR Table 3.0-1. Therefore, the FSAR supplement for the Containment Inservice Inspection – IWE AMP is consistent with the corresponding program description in SRP-LR Table 3.0-1. The staff's concern described in RAI A.1.6-1 is resolved.

The staff also noted that the applicant committed to implement the enhancement to the program prior to entering the period of extended operation (commitment no. 5 as listed in Appendix A). The staff finds that the information in the FSAR supplement, as amended by letter October 13, 2016, is an adequate summary description of the program.

Conclusion. Based on its audit, and review of the applicant's Containment Inservice Inspection – IWE AMP and responses to RAIs by letter dated October 13, 2016, and associated revision by letter dated January 19, 2017, the staff determines that those elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 FSAR supplement for this AMP, as amended by letter dated October 13, 2016, 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 Diesel Fuel Monitoring

Summary of Technical Information in the Application. LRA Section B.1.8 describes the existing Diesel Fuel Monitoring program as consistent, with enhancements, with GALL Report AMP XI.M30, "Fuel Oil Chemistry." The LRA states that this program manages loss of material and reduction of heat transfer due to fouling in piping, tanks, and other components in a diesel fuel oil environment. The LRA states that parameters monitored include water content, sediment, total particulate, and levels of microbiological activity. The program includes multi-level sampling of fuel oil storage tanks where possible, and, where multilevel sampling is not possible due to design, a representative sample is taken from the lowest part of the tank. The program also includes inspections of low-flow areas where contaminants may collect, such as in the bottom of tanks. The tanks are periodically sampled, drained, cleaned, and internally inspected for signs of moisture, contaminants, and corrosion. The LRA also states that "internal tank inspections will be performed 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."

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 "scope of program," "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.1.8 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the procedures for the Diesel Fuel Monitoring program will be revised to include the auxiliary diesel generator fuel oil tank and the EDG fuel oil feed tanks. 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 be consistent with the guidance in the GALL Report.

Enhancement 2. LRA Section B.1.8 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that the procedures for the Diesel Fuel Monitoring program will be revised "to monitor and trend water content, sediment, particulates, and microbiological activity in the fuel oil tanks within the scope of the program at least quarterly." 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 be consistent with the guidance in the GALL Report.

Enhancement 3. LRA Section B.1.8 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the procedures for the Diesel Fuel Monitoring program will be revised to include periodic multi-level sampling of tanks within the scope of the program and if the tank design does not allow for multi-level sampling, to include provisions to obtain a representative sample from the lowest point in the tank. 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 be consistent with the guidance in the GALL Report.

Enhancement 4. LRA Section B.1.8 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the procedures for the Diesel Fuel Monitoring program will be revised to include periodic cleaning and internal visual inspection of tanks within the scope of the program. In the areas of any degradation identified during the internal inspection, a volumetric inspection shall be performed. In the event that an internal inspection cannot be performed due to design limitations, a volumetric examination shall be performed. In addition, the applicant shall perform cleaning and internal inspections at least once during the 10-year period prior to the period of extended operation and at succeeding 10-year intervals. 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 be consistent with the guidance in 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 "scope of program," "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.1.8 summarizes operating experience related to the Diesel Fuel Monitoring program.

The LRA states that in December 2013, during routine sampling, the applicant identified an adverse trend for diesel fuel oil particulate level. The samples taken reviewed indicated adverse trend levels; however, the samples were within specification limits. Additionally, the applicant had the samples evaluated by an offsite laboratory and determined that no adverse trend existed.

The LRA states that in March 2013, during an assessment by the Institute of Nuclear Power Operations (INPO), it was discovered that the applicant's diesel fuel was not being routinely monitored for biodiesel or lubricity in accordance with industry guidance. Procedures were revised to include biodiesel and lubricity analysis on all diesel fuel oil receipts. In addition, changes were made to the contract with the diesel fuel supplier to require the supplier to perform biodiesel and lubricity analysis on diesel fuel oil shipments.

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 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.

FSAR Supplement. LRA Section A.1.8 provides the FSAR supplement for the Diesel Fuel Monitoring program. The staff reviewed this FSAR 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 Diesel Fuel Monitoring program for managing the effects of aging for applicable components during the period of extended operation (commitment no. 6 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Diesel Fuel Monitoring program, the staff determines that those program elements for which the applicant claimed consistency with GALL Report AMP XI.M30 are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 External Surfaces Monitoring

Summary of Technical Information in the Application. LRA Section B.1.10 describes the existing External Surfaces Monitoring program as consistent, with enhancements, with GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," as modified by

LR-ISG-2011-03, “Generic Aging Lessons Learned (GALL) Report Revision 2 AMP XI.M41, ‘Buried and Underground Piping and Tanks,’” and 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 metallic, elastomeric, and polymeric components to manage the aging effects of loss of material, cracking, and changes in material properties. The LRA also states that the AMP proposes to manage these aging effects through periodic visual inspections and physical manipulation (for flexible polymers). The LRA further states that to address corrosion under insulation, periodic visual inspections will be conducted on a representative sample of external surfaces under insulation.

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.

For the “parameters monitored or inspected” program element, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The “parameters monitored or inspected” program element in GALL Report AMP XI.M36 recommends inspections for leakage to identify cracking of stainless steel external surfaces exposed to air environments containing halides. During its review, the staff noted that for stainless steel components in LRA Tables 3.3.2-4, 3.3.2-11, 3.3.2-12, 3.3.2-14, 3.3.2-15-6, and 3.4.2-4 that have a gaseous, condensation, or indoor air internal environment, it is not clear how inspections of external surfaces will effectively use leakage as an indicator of cracking. In addition, the staff noted that methods for detecting cracking in aluminum components in LRA Tables 3.3.2-3 and 3.3.2-13 are not specified in the External Surfaces Monitoring program. By letter dated November 7, 2016, the staff issued RAI B.1.10-4 requesting that the applicant state: (1) the parameters monitored and the inspection methods that will be used to determine whether cracking is present in the stainless steel components in LRA Tables 3.3.2-4, 3.3.2-11, 3.3.2-12, 3.3.2-14, 3.3.2-15-6, and 3.4.2-4 with a gaseous, condensation, or indoor air internal environment; and (2) the inspection parameters monitored and the inspection methods that will be used to determine whether cracking is present in the aluminum components in LRA Tables 3.3.2-3 and 3.3.2-13.

In its response dated December 7, 2016, the applicant (1) stated that the External Surfaces Monitoring program manages cracking of stainless steel components in the compressed air (LRA Table 3.3.2-4) and nitrogen (LRA Table 3.3.2-11) systems through system walkdowns during which leakage through a crack can be detected by audible sound from the escaping compressed air or nitrogen; (2) confirmed that stainless steel components that credit the External Surfaces Monitoring program in the plant drains (LRA Table 3.3.2-14) and boron management (LRA Table 3.3.2-15-16) systems have an aqueous internal environment; (3) stated that stainless steel components in the main steam system (LRA Table 3.4.2-4) are exposed to an internal environment of steam and that inspections during system walkdowns can detect leakage by indications of steam plumes and water vapor in the surrounding areas, or audible sounds from the escaping steam; (4) stated that cracking is not an AERM for the stainless steel tubing with an indoor air internal environment in the miscellaneous heating, ventilation, and air conditioning (HVAC) (LRA Table 3.3.2-12) system based on a review of operating experience, which showed no instances of cracking of stainless steel tubing exposed to outdoor air; (5) stated that the aluminum heat exchanger fins in the component cooling/auxiliary component cooling water (LRA Table 3.3.2-3) system are not pressure boundary components, so inspection for leakage to indicate cracking is not applicable; and (6) stated that the aluminum flame arrestor in the auxiliary diesel generator (LRA

Table 3.3.2-13) system was removed from the LRA because it does not perform the license renewal intended function of pressure boundary.

The staff finds the applicant's response (as numbered respective to the preceding paragraph) acceptable in part because (1) the audible sound of escaping compressed air (LRA Table 3.3.2-4) or nitrogen (LRA Table 3.3.2-11) is an effective indicator of cracking; (2) the applicant confirmed that stainless steel components in the plant drains (LRA Table 3.3.2-14) and boron management (LRA Table 3.3.2-15-16) systems have an aqueous internal environment; therefore, leakage is an effective indicator of cracking; and (3) indications of steam plumes, water vapor, or audible sounds from the escaping steam (LRA Table 3.4.2-4) are effective indicators of cracking. However, the staff noted that it was unclear why (4) cracking is not an applicable aging effect for the stainless steel plant stack monitoring instrument tubing (LRA Table 3.3.2-12), given that chloride contamination of stainless steel components may occur; (5) the aluminum heat exchanger fins (LRA Table 3.3.2-3) performing a heat transfer intended function, as opposed to a pressure boundary intended function, precludes the need to manage cracking for these components; and (6) the aluminum flame arrestor (LRA Table 3.3.2-13) was removed from the LRA, given that it may perform another license renewal intended function.

By letter dated December 19, 2016, the staff issued RAI B.1.10-4a requesting that the applicant: (1) justify why cracking is not an applicable aging effect for the stainless steel plant stack monitoring instrument tubing, given that chloride contamination of stainless steel components exposed to outdoor air may occur; (2) justify why the aluminum heat exchanger fins performing a heat transfer intended function, as opposed to a pressure boundary intended function, precludes the need to manage these components for cracking; and (3) provide additional detail to justify why the aluminum flame arrestor does not perform a license renewal intended function.

In its response dated February 1, 2017, the applicant (1) stated that although operating experience did not identify cracking of stainless steel components exposed to outdoor air, cracking of the steel plant stack monitoring instrument tubing will be managed using the One-Time Inspection program to provide reasonable assurance that aging effects are not resulting from exposure to contaminants in outdoor air; (2) stated that the Periodic Surveillance and Preventive Maintenance program will manage cracking of the aluminum heat exchanger fins and that indications of cracking are loose, missing, or detached fins; and (3) restored the aluminum flame arrestor items in LRA Table 3.3.2-13, with the exception of items associated with cracking. The applicant stated that cracking of the aluminum flame arrestor is not an AERM because the component is fabricated from ASME Code Section II, Alloy 3003, which contains a maximum of 0.1 percent zinc and 1.5 percent manganese, which is below the threshold for the development of SCC.

The staff finds the applicant's response acceptable because (1a) during the staff's development of aging management guidance for subsequent license renewal (ADAMS Accession No. ML16041A090), the staff revised the further evaluation for cracking due to SCC of stainless steel alloys exposed to outdoor air to state that cracking is not applicable and does not require management if plant-specific operating experience does not reveal a history of SCC and a one-time inspection demonstrates that the aging effect is not occurring; (1b) the applicant's One-Time Inspection program will employ established visual, ultrasonic, or surface examination techniques capable of confirming that cracking is not occurring or is occurring so slowly that it will not affect the component intended function during the period of extended operation; (2) the Periodic Surveillance and Preventive Maintenance program employs visual inspections for loose, missing, or detached fins at least once every 5 years, which are capable of detecting

cracking from aluminum heat exchanger fins prior to the loss of the component intended function; and (3) during the staff's development of aging management guidance for subsequent license renewal (ADAMS Accession No. ML16041A090), the staff determined that 3xxx series aluminum alloys are not susceptible to SCC. The staff's concerns described in RAIs B.1.10-4 and B.1.10-4a are resolved.

The staff also reviewed the portions of the "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.1.10 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the plant-specific procedures will be revised to include instructions to perform a 100-percent visual inspection of accessible flexible polymeric component surfaces. Specifically, the enhancement includes visual inspections to identify indicators of loss of material due to wear to include dimensional change, surface cracking, crazing, scuffing, and for flexible polymeric materials with internal reinforcement, the exposure of reinforcing fibers, mesh, or underlying metal. The enhancement also includes provisions to physically manipulate 10 percent of the available flexible polymeric surface area to augment visual inspections to confirm the absence of hardening and loss of strength. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and finds it acceptable because when it is implemented it will ensure that the inspections of polymeric component surfaces will be consistent with the GALL Report recommendations.

Enhancement 2. LRA Section B.1.10 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that plant-specific procedures will be revised to include provisions for conducting representative inspections during each 10-year period on insulated surfaces of each material type (e.g., steel, stainless steel, copper alloy, aluminum) in an outdoor air or condensation environment. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and finds it acceptable because when it is implemented it will be consistent with the GALL Report recommendations, which state "inspections are conducted of each material type and environment where condensation or moisture on the surfaces of the component could occur routinely or seasonally."

Enhancement 3. LRA Section B.1.10 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the plant-specific procedures will be revised to: (1) include the removal of insulation in order to perform visual inspections of a representative sample of the insulated indoor component surfaces in a condensation environment and outdoor component surfaces, where the inspections shall include either a minimum of 20 percent of the in-scope piping length, 20 percent of the surface area, or 25 inspections of 1-ft. axial length sections for each material type; (2) include inspection locations based on the likelihood of corrosion under insulation; (3) allow subsequent inspections to consist of an examination of the exterior surface of the insulation for indications of damage to the jacketing or protective outer layer of the insulation if there is no evidence of cracking and no evidence of loss of material beyond that which could have been present during initial construction; and (4) ensure that periodic inspections under insulation will continue in order to ensure the component's intended function if external visual inspections reveal damage to the insulation or otherwise reveal water intrusion. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and finds it acceptable because

when it is implemented it will ensure that inspections of insulated components will be consistent with GALL Report recommendations.

Enhancement 4. LRA Section B.1.10 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that the plant-specific procedures will be revised to provide guidance that removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage to the moisture barrier. The enhancement further states that the entire accessible population of piping component surfaces that are in scope and have tightly adhering insulation will be visually inspected for damage to the moisture barrier with a frequency consistent with other types of insulation inspections and that these inspections will not be credited toward the inspection quantities for other types of insulation. The “detection of aging effects” program element in GALL Report AMP XI.M36 recommends visual inspection of the *entire* population of in-scope piping with tightly adhering insulation. However, during the audit, the staff noted that the applicant’s External Surfaces Monitoring program states that “the entire population of in-scope *accessible* piping component surfaces that have tightly adhering insulation will be visually inspected.” By letter dated October 12, 2016, the staff issued RAI B.1.10-1 requesting that the applicant describe usage of the term “accessible” and explain why it is adequate.

In its response dated November 10, 2016, the applicant stated that at WF3 no inaccessible components with tightly adhering insulation have been identified that are in scope and subject to an AMR for license renewal. The applicant further stated that the word “accessible” will be deleted. The staff finds the applicant’s response acceptable because with the deletion of the word “accessible” from the enhancement, any components with tightly adhering insulation that are identified will be evaluated whether regularly accessible or not. The staff’s concern described in RAI B.1.10-1 is resolved.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and finds it acceptable because when it is implemented it will ensure that inspections of components with tightly adhering insulation will be consistent with GALL Report recommendations.

Enhancement 5. LRA Section B.1.10 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that the plant-specific procedures will be revised to include the following acceptance criteria: (a) stainless steel should have a clean shiny surface with no discoloration; (b) other metals should not have any abnormal surface indications; (c) flexible polymeric materials should have a uniform surface texture and color with no cracks and no unanticipated dimensional change, no abnormal surface with the material in an as new condition with respect to hardness, flexibility, physical dimensions, and color; and (d) rigid polymeric materials should have no erosion, cracking, checking, or chalking. The “acceptance criteria” program element in GALL Report AMP XI.M36 recommends that for visual inspection of flexible polymers no dimensional change is expected. However, during its audit, the staff found that the applicant’s External Surfaces Monitoring program stated “flexible polymeric materials should have […] no *unanticipated* dimensional change.” By letter dated October 12, 2016, the staff issued RAI B.1.10-3 requesting that the applicant describe usage of the term “unanticipated” and explain why it is adequate.

In its response dated November 10, 2016, the applicant stated that the word “unanticipated” is removed from the LRA to be consistent with LR-ISG-2012-02. The staff finds the applicant’s response acceptable because with removal of the word “unanticipated,” any dimensional

change of an in-scope polymeric material will be evaluated. The staff's concern described in RAI B.1.10-3 is resolved.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M36 and finds it acceptable because when it is implemented it will ensure that evaluations of component surfaces will be consistent with GALL Report recommendations.

Based on its audit, and review of the applicant's responses to RAIs B.1.10-1 and B.1.10-3, 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. In addition, the staff reviewed the enhancements associated with the "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.1.10 summarizes operating experience related to the External Surfaces Monitoring program. In 2006, the applicant conducted a self-assessment of the external corrosion program, which resulted in the development of a master list of external corrosion issues. The self-assessment also found that corrective action plans for previous events were adequate. In 2013, severe external corrosion was identified on a nonsafety-related pipe. The pipe was determined to remain functional and was scheduled for replacement. In 2014 and 2015, the applicant identified adverse trends in the number of instances of external corrosion potentially affecting safety-related equipment. Identification of the adverse trends has resulted in several actions to develop procedures to identify, track, and mitigate external 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 identified operating experience for which it determined the need for additional clarification and resulted in the issuance of RAI B.1.10-2, as discussed below.

During the AMP audit, recent plant-specific operating experience and associated actions regarding external corrosion were reviewed. Review of this information has shown that external corrosion of steel components exposed to an outdoor air environment is a significant issue at WF3. In particular, WF3 Licensee Event Report (LER) 2014-004-03 states that through-wall corrosion was identified on the Emergency Diesel Generator Feed Tank vent lines where the vent lines pass through the roof. An NRC inspector identified the corrosion and it was unknown how long the through-wall corrosion had existed. A fleet procedure change is being developed that could potentially address the plant-specific operating experience. As presented to the staff, the fleet procedure did not address all components within the scope of license renewal. By letter dated October 12, 2016, the staff issued RAI B.1.10-2 requesting that the applicant describe how the fleet procedure will be used to manage aging effects during the period of extended operation.

In its response dated November 10, 2016, the applicant stated that the referenced fleet procedure provides guidance for the conduct of system walkdowns and adds a step to establish written walkdown plans for all Category 1 systems. Walkdown plans are not required for

non-Category 1 systems, but all systems within the scope of license renewal must undergo system walkdown inspections to support AMPs for plants with renewed licenses. Additionally, during the period of extended operation, a list of the systems that require visual inspection and that are in scope of license renewal shall be maintained by WF3. Inspections will include areas surrounding safety-related systems and nonsafety-related systems in scope and subject to an AMR in accordance with 10 CFR 54.4(a)(2). The applicant further stated that the fleet procedure is an implementing procedure for the External Surfaces Monitoring program, and that Entergy's practice during implementation is to annotate procedures credited for managing aging and to identify them as provisions associated with regulatory commitments, and to prevent change without following the process for managing regulatory commitments.

The staff finds the applicant's response acceptable because the referenced fleet procedure will be used as an implementing procedure for the External Surfaces Monitoring program and the use of lists to track all in-scope components requiring walkdowns will provide reasonable assurance that in-scope components such as the EDG vent lines will not be overlooked in walkdowns during the period of extended operation. The staff's concern described in RAI B.1.10-2 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.1.10-2, 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.M36 was evaluated.

FSAR Supplement. LRA Section A.1.10 provides the FSAR supplement for the External Surfaces Monitoring program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff noted that the applicant committed to ongoing implementation of the existing External Surfaces Monitoring program with enhancements for managing the effects of aging for applicable components during the period of extended operation (commitment no. 7 as listed in Appendix A). The applicant committed to implement the enhancements to the program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's External Surfaces Monitoring program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Fatigue Monitoring

Summary of Technical Information in the Application. LRA Section B.1.11 describes the existing Fatigue Monitoring program as consistent, with enhancements, with GALL Report AMP X.M1, “Fatigue Monitoring.”

The LRA states that the AMP ensures that fatigue usage remains within the allowable limits for those components with fatigue evaluations that have been identified as TLAAs. The LRA states that the AMP proposes to accomplish this by tracking the number of critical thermal and pressure transients, verifying that the severity of monitored transients are bounded by the design transient definitions, and assessing the impact of the reactor coolant environment on a set of critical components. The LRA states that, by tracking and monitoring plant transients that cause significant fatigue usage, the applicant can ensure that the cumulative usage factor (CUF) will remain within the allowable limits, including the effects of the reactor coolant environment where applicable. The LRA also states that the program also provides for updates to the fatigue usage calculations on an as-needed basis to account for cycle limits being approached, new transient definitions, unanticipated and new thermal events, or modification of component geometry.

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” and “detection of aging effects” 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.1.11 includes an enhancement to the “scope of program” program element. In this enhancement, the applicant stated that the Fatigue Monitoring program procedures will be revised to monitor and track additional critical thermal and pressure transients for components that have been identified as having a fatigue TLAA. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP X.M1 and finds it acceptable because when it is implemented, it will monitor and track all of the critical thermal and pressure transients that affect the fatigue TLAA evaluations of the selected components and, therefore, will ensure that the fatigue usage will remain within the allowable limits.

Enhancement 2. LRA Section B.1.11 includes an enhancement to the “scope of program” program element. In this enhancement, the applicant stated that the effects of reactor coolant water environment will be evaluated for a set of sample RCS components that include the NUREG/CR–6260 locations and additional, limiting plant-specific locations. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP X.M1 and finds it acceptable because when it is implemented, it will ensure that the fatigue evaluations will account for the effects of the reactor coolant environment for NUREG/CR–6260 locations and more limiting, plant-specific locations, and, therefore, will ensure that the associated cycle limits will not be exceeded.

Enhancement 3. LRA Section B.1.11 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that the Fatigue Monitoring program procedures will be revised to provide updates of the fatigue usage calculations as

needed if an allowable cycle limit is approached, a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components have been modified. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP X.M1 and finds it acceptable because when it is implemented, it will ensure that the fatigue evaluations will represent actual plant parameters and configurations throughout the period of extended operation.

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.M1. In addition, the staff reviewed the enhancements associated with the “scope of program” 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.1.11 summarizes operating experience related to the Fatigue Monitoring program. In August 2004, the LRA states that site personnel found that a pressurizer thermal transient analysis did not fully consider the impact of all transients. The LRA states that as a result, the predicted fatigue usage factor of the lower vessel region and existing flaw analyses may not have been bounding. The applicant initiated corrective actions to: (a) recalculate the analysis to address the applicable transients, and (b) incorporate the new results into the design basis documents, licensing basis documents, and operating limits in site procedures.

The staff identified operating experience for which it determined the need for additional clarification and resulted in the issuance of an RAI, as discussed below. The staff issued NRC Regulatory Issue Summary (RIS) 2008-30, by letter dated December 16, 2008, which discusses the staff’s concerns that the use of certain simplified analysis methodology to demonstrate compliance with the ASME Code fatigue acceptance criteria could be nonconservative. When a license renewal applicant has used the simplified methodology, a confirmatory analysis is needed to demonstrate that the simplified analysis provides acceptable and appropriately conservative results. The staff noted that the LRA does not address how the staff’s concerns in RIS 2008-30 have been addressed. By letter dated September 15, 2016, the staff issued RAI B.1.11-1 to request that the applicant state whether the simplified methodology was used to demonstrate compliance with the ASME Code fatigue acceptance criteria for WF3. If the simplified methodology was used, the staff requested that the applicant address the concerns in RIS 2008-30. By letter dated October 13, 2016, the applicant responded to RAI B.1.11-1. In its response, the applicant stated that the Fatigue Monitoring program does not credit the simplified stress-based fatigue usage calculation, and therefore, the staff’s concerns in RIS 2008-30 are not applicable. The staff finds the applicant’s response acceptable because the applicant confirmed that the staff’s concerns in RIS 2008-30 do not apply and therefore, further confirmatory evaluations are not required. The staff’s concerns in RAI B.1.11-1 are resolved.

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.

Based on its audit and review of the application, and review of the applicant’s responses to RAI B.1.11-1, 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 X.M1 was evaluated.

FSAR Supplement. LRA Section A.1.11 provides the FSAR supplement for the Fatigue Monitoring program. The staff reviewed this FSAR supplement description of the program. 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 (commitment no. 8 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on 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. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Fire Protection

Summary of Technical Information in the Application. LRA Section B.1.12 describes the existing Fire Protection program as consistent, with enhancements, with GALL Report AMP XI.M26 "Fire Protection." The LRA states that the AMP manages cracking, loss of material, delamination, separation, and change in material properties of components and structures with a fire barrier intended function (i.e., seals, fire barrier walls, fire wrapping) through periodic inspection. The LRA also states that visual inspections of not less than 10 percent of each type of penetration fire seal would be performed at least once every refueling cycle. The LRA further states that fire doors undergo periodic visual inspection and functional testing to ensure operability.

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 "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.1.12 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Protection program procedures will be revised to include an inspection of fire barrier walls, ceilings, and floors for signs for degradation, such as spalling, loss of material caused by chemical attack, or reaction with aggregates at least once every refueling cycle. 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 be consistent with the GALL Report recommendations on inspection of fire barrier walls, ceilings, and floors.

Enhancement 2. LRA Section B.1.12 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Protection program procedures will be revised to inspect fire-rated doors for any degradation of door surfaces at least once every refueling cycle. 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 be consistent with the GALL Report recommendations on the inspection of fire doors.

Enhancement 3. LRA Section B.1.12 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the Fire Protection program procedures will be revised to ensure inspections of fire barrier seals are inspected by personnel qualified in accordance with appropriate NFPA standards. 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 with the GALL Report recommendations on the qualification of fire inspection personnel.

Enhancement 4. LRA Section B.1.12 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the Fire Protection program procedures will be revised to provide acceptance criteria of no significant indications of concrete spalling and loss of material of fire barrier walls, floors, and in other fire barrier materials. 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 be consistent with the GALL Report recommendations on acceptance criteria for fire barrier walls, floors, and other fire barrier materials.

Enhancement 5. LRA Section B.1.12 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the Fire Protection program procedures will be revised to provide acceptance criteria that specify no surface degradation of fire doors. 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 be consistent with the GALL Report recommendations on the inspection of fire doors.

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 "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.1.12 summarizes operating experience related to the Fire Protection program. The applicant stated that cracks in a Pyrocrete (a hydrate material containing chemically bonded water, Ref: NUREG–1924, "Electric Raceway Fire Barrier Systems in U.S. Nuclear Power Plants," 2010) fire barrier were discovered during a 2004 visual inspection of fire rated floors, walls, and ceilings; the fire barrier was subsequently repaired. In addition, the applicant stated that an issue of how to document the accessibility of fire seals arose during a self-assessment in 2009. The applicant further stated that because WF3 inspects all penetration seals, the documentation of accessibility of fire seals is not an issue. In addition, a crack below the top hinge of a fire door was identified during an inspection in 2013. The fire door was capable of performing its fire barrier function despite the defect. Finally, the latching mechanism of a fire door to the emergency feedwater pump room was repaired by

lubrication after it was found incapable of self-latching. Self-latching is a requirement for access doors under the NFPA 80 Standard for Fire Doors and Other Opening Protectives (2013).

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.

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.M26 was evaluated.

FSAR Supplement. LRA Section A.1.12 provides the FSAR supplement for the Fire Protection program. The staff reviewed this FSAR 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 enhancing the existing Fire Protection program to manage the effects of aging for applicable components during the period of extended operation (commitment no. 9 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on 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 GALL Report AMP XI.M26 are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fire Water System

Summary of Technical Information in the Application. LRA Section B.1.13 describes the existing fire water system with exceptions and enhancements as consistent 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 water-based fire suppression system components to manage the effects of loss of material, flow blockage due to fouling, and loss of coating integrity. The LRA also states that the AMP proposes to manage these aging effects through periodic flow testing, visual inspections, volumetric wall thickness measurements, and flushing. The LRA further stated that water system pressure is continuously monitored.

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 7 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M27, as modified by LR-ISG-2012-02.

The staff also reviewed the portions of the "detection of aging effects," "acceptance criteria," and "corrective actions" 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.

Exception 1. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it will conduct sprinkler inspections every refueling cycle (i.e., 18 months) in lieu of every 12 months required by NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," Section 5.2.1, because some inspections are only feasible during refueling outages, and this interval has been effective at maintaining the sprinkler's intended function. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because consistent with the applicant's statement regarding a lack of past inspection findings, the staff's independent search of plant-specific operating experience during the audit did not reveal any evidence that sprinkler age-related degradation was occurring, and there is a large enough number of sprinklers installed at the applicant's site to establish an adverse performance trend, even with plant-specific inspections being completed on an 18-month basis rather than annually.

Exception 2. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it will perform "main header flow testing in the main headers that supply the standpipe system to verify the water supply provides the design pressure and required flow." This testing is in lieu of flow testing every 5 years at the hydraulically most remote hose connections of each zone of an automatic standpipe system to verify that the water supply still provides the design pressure at the required flow as required by NFPA 25 Section 6.3.1. The applicant stated that it tests the fire hoses listed in the Technical Requirements Manual every 3 years and performs main drain tests every 18 months. The acceptance criteria for the valves and connections is flow with "no indications of obstruction or undue restriction of water flow." The applicant also stated that it uses Class 2 standpipe systems, and the 2014 Edition of NFPA 25 only requires this testing for Classes 1 and 3 standpipe systems.

The staff noted that NFPA 25 Section 6.3.1 requires flow testing to be conducted every 5 years in order to detect potential flow blockage. As stated in NFPA 25, a Class II standpipe system is differentiated from Class I and Class III systems based on the size of the hose stations supplied by the standpipe and its use (e.g., a Class III system supplies a larger volume of water for use by fire departments). During the audit, the staff confirmed that the applicant conducts flow testing, as described above, for 76 hose stations located in the Reactor Auxiliary Building, Fuel Handling Building (FHB), DCT, Turbine Building, Reactor Building, and support buildings, and that flow is confirmed at each hose station every 3 years. The staff determined that flow is verified but not measured at hose stations. During the audit, the staff also confirmed that the applicant conducts flow testing at two remote hose stations, defined as "the farthest fire hoses from the Fire Pumps." Acceptance criteria for the remote hose stations (conducted every 5 years) is, "[f]or each hose station being tested in Attachment 10.3 [remote hose stations], if Hose Station residual pressure is <65 PSI or flow rate is <100 GPM, then data must be submitted to the FP Engineer for evaluation of acceptance." There are two remote hose stations, one in the FHB and one in the Turbine Building.

The staff reviewed this exception against the corresponding program element in AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because the proposed alternative testing is sufficient to establish reasonable assurance that flow blockage will be detected prior to

a CLB intended function not being met. The staff based this conclusion on: (a) the alternative flow verifications, both in number, breadth of locations, and frequency, provide insights concerning potential accumulation of corrosion products that are comparable to insights gained from the test recommended in AMP XI.M27, as modified by LR-ISG-2012-02; (b) in regard to the number of tests, flow is verified at 76 hose stations, tested every 3 years; (c) in regard to the breadth of testing, tests are conducted on hose stations located in four different buildings with in-scope components as well as service buildings; (d) in regard to the frequency of testing, the alternative tests are conducted more frequently than every 5 years; (e) two quantifiable flow tests are conducted at remote locations; and (f) NFPA 25 (2014 Edition), an industry consensus document, has removed the requirement to conduct the test for the class of standpipe used at the station.

Exception 3. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it performs main drain tests on a refueling outage cycle in lieu of annual testing as required by NFPA 25 Section 13.2.5.

During the audit, the staff confirmed that the applicant conducts 37 main drain tests every 18 months. The staff noted that NFPA 25 was written for a broad range of facilities, including those conducting a few main drain tests at its standpipe locations (e.g., a small manufacturing facility with only one or two standpipes) and those with numerous standpipes as is typical for plants). The staff noted that 37 tests exceeds the number of recommended tests or inspections (i.e., 25) in several sampling-based AMPs (e.g., XI.M38). The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because the number of main drain tests being conducted every 18 months in lieu of 12 months is sufficient to establish a trend if potential flow blockage is occurring.

Exception 4. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it will perform full flow testing of the piping downstream of the deluge valves for transformers, but does not perform an internal inspection of the dry piping downstream of the deluge valves for the transformers.

During the audit, the staff reviewed the plant-specific procedures for deluge testing of the transformers. The staff verified that the applicant tests the piping downstream of the deluge valves by confirming that upon flow initiation, the water pressure drops to approximately 0 psig upon opening the deluge valve and returns to the pre-test pressure when the valve is closed. This testing can verify that there is no bulk blockage in the lines downstream of the deluge valves. In addition, the test procedures verify flow is observed at each nozzle, and spray pattern abnormalities are documented. The staff reviewed this exception against the corresponding program element in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because the flow testing and observation of nozzle spray patterns provides sufficient insights in relation to potential blockage in the piping downstream of the deluge valves.

Exception 5. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it does not conduct a cross-hatch test as described in ASTM D 3359, "Standard Test Methods for Measuring Adhesion by Tape Test," and required by NFPA 25 Section 9.2.7.1, when signs of pitting, corrosion, or failure of the coating are detected. The applicant stated that it: (a) inspects the tank interior coating for damage, chips, blisters, peeling, pinholes, rust, or any local or general failure of the coating every 5 years; (b) performs ultrasonic thickness checks or mechanical measurements of any

identified corroded areas; and (c) performs spot wet sponge tests and dry film testing to identify coating adhesion deficiencies. As stated in Enhancement 21, the applicant will "determine the extent of coating defects on the interior of the fire water tanks by using one or more of the following methods when conditions such as cracking, peeling, blistering, delamination, rust, or flaking are identified during visual examination." These methods include:

> (a) lightly tapping and scraping the coating to determine the coating integrity; (b) dry film thickness measurements at random locations to determine overall thickness of the coating; (c) wet-sponge testing or dry film testing to identify holidays in the coating; (d) adhesion testing in accordance with ASTM D3359, ASTM D4541 [Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers], or equivalent testing endorsed by RG [Regulatory Guide] 1.54 [Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants] at a minimum of three locations; or (e) ultrasonic testing where there is evidence of pitting or corrosion to determine if the tank thickness meets the minimum thickness criteria.

The staff noted that the applicant will enhance its procedures (Enhancement 17) to require individuals that evaluate coating degradation of the fire water storage tanks to be qualified in accordance with ASTM International standards endorsed in RG 1.54, including limitations, if any, identified in RG 1.54 on a particular standard. The staff also noted that Footnote 5 states: "lightly tapping, scraping or cleaning the degraded area per Society of Protective Coatings (SSPC) SSPC-SP2, Hand Tool Cleaning; SSPC-SP3, Power Tool Cleaning; SSPC-SP11, Cleaning of Bare Metal; and SSPC-SP WJ-1, 2, 3 and 4, Water Jet Cleaning…" are means to allow a qualified inspector and engineering to determine the extent of peeling, delamination, and blistering. The SSPC standards are industrywide recognized standards for the surface preparation of noncoated and coated surfaces that provide sufficient direction to ensure that surfaces are properly prepared. The staff confirmed, by attendance at the EPRI Comprehensive Coatings Training Course, that tap testing is an effective method to detect coating adhesion degradation. The staff finds the use of lightly tapping the coating and scraping or cleaning the coating in accordance with SSPC-cited standards to determine the coating integrity acceptable because: (a) a combination of the use of industry consensus documents and training will be used to ensure that consistent results can be obtained when testing in the vicinity of degraded coatings; (b) the cited example SSPC standards can be used to demonstrate that loose degraded coatings do not remain in the vicinity of coatings adhering to a surface; and (c) where system flow rates are low (i.e., tanks and piping where laminar flow conditions exist), there is reasonable assurance that the use of light tapping, light hand scraping, or light power tool cleaning as an alternative to adhesion testing will be sufficient to detect coatings that are not adhering to the substrate. In addition, the staff finds it acceptable to use ASTM D3359 and D4541 to conduct adhesion testing because these standards have been endorsed by the staff in either RG 1.54 or AMP XI.M27, as modified by LR-ISG-2012-02. The staff also finds the methods described in Enhancement 21 to be effective means to identify the associated degraded conditions because they are industry-recognized methods for detecting issues associated with coating adhesion, thickness of coatings, holidays, or remaining wall thickness where loss of material has occurred. However, spot wet sponge tests and dry film testing are not effective methods to identify coating adhesion deficiencies. By letter dated October 12, 2016, the staff issued RAI B.1.13-1 requesting that the applicant state the basis for why spot wet sponge tests and dry film testing are effective means to identify coating adhesion deficiencies.

In its response dated November 10, 2016, the applicant stated that the wet sponge and dry film testing methods are not intended to determine the quality or degree of coating adhesion. The applicant revised the justification for Exception 5 to remove the references to spot wet sponge tests, dry film testing, and ultrasonic thickness measurements of corroded areas.

The staff noted that ultrasonic thickness measurements of corroded areas would not provide any information related to adhesion of coatings.

The staff finds the applicant's response acceptable because removal of the references to spot wet sponge tests, dry film testing, and ultrasonic thickness measurements of corroded areas from the justification for the exception eliminates future potential misinterpretation that the staff considers these methods effective at detecting lack of adhesion. The staff's concern described in RAI B.1.13-1 is resolved.

The staff finds Exception 5 acceptable because the methods that will be used in lieu of cross-hatch testing can be capable of detecting coating adhesion.

Exception 6. LRA Section B.1.13 includes an exception to the "detection of aging effects" program element. In this exception, the applicant stated that it trip tests the preaction valves with the control valves cracked open in lieu of testing with the control valve in the full open position as required by NFPA 25 Section 13.4.3.2.3.

The staff reviewed this exception against the corresponding program element in AMP XI.M27, as modified by LR-ISG-2012-02, and does not find it acceptable because: (a) the staff lacks sufficient information to conclude that adequate flow to detect potential flow blockage will be achieved during the test; and (b) NFPA 25 Section 13.4.3.2.2.5 allows air to be used as a test medium when the nature of the protected property is such that water cannot be discharged. By letter dated October 22, 2016, the staff issued RAI B.1.13-2 requesting that the applicant state and justify the basis for why flow rates sufficient to detect flow blockage will be achieved during preaction valve testing with the control valve cracked open.

In its response dated November 10, 2016, the applicant stated that the exception incorrectly stated the preaction valves are trip tested. The applicant stated that it performs drain tests every 18 months on each in-scope preaction system with the manual valve open and the preaction valve closed. During this test, an upstream drain valve is opened to verify that there is adequate flow. As stated in Enhancement Nos. 3 and 4, the piping downstream of the preaction valves and automatic deluge systems is internally inspected for presence of materials that could obstruct flow. As modified by letter dated November 10, 2016: (a) Exception 6 was modified to cite the upstream flow testing; (b) Enhancements 3 and 4 were modified to state that the inspections will be conducted by opening a flushing connection and removing the most remote sprinkler to conduct the internal visual inspections; and (c) the inspections will be conducted every 5 years. The applicant also stated that an enhancement was added, Enhancement 27, to perform trip testing of the preaction valves every 3 years with the manual isolation valve closed.

The staff noted that conducting internal visual inspections every 5 years by opening a local flushing connection and the most remote sprinkler is consistent with NFPA 25 Section 14.2. During the audit, the staff confirmed that there are 37 main drain connections (preaction systems): 9 in the Turbine Building, 1 in the FHB, 2 in the Reactor Building, 16 in the Reactor Auxiliary Building, 7 in the yard areas, and 2 in the diesel engine fuel oil storage tank area. The staff noted that conducting drain tests every 18 months on each in-scope preaction system can

provide a sample size, breadth of locations, and frequency sufficient to detect potential flow blockage.

The staff finds the applicant's response and Exception 6 acceptable because the combination of flow testing and visual inspections can be capable of detecting potential flow blockage in the piping prior to a loss of intended function. The staff's concern described in RAI B.1.13-2 is resolved.

<u>*Enhancement 1*</u>. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to "inspect for loss of fluid in the glass bulb heat responsive elements." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it will make the procedures consistent with NFPA 5.2.1.1.2, sprinkler inspections, and AMP XI.M27 Table 4a, "Fire Water System Inspection and Testing Recommendations."

<u>*Enhancement 2*</u>. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to:

> perform an inspection of wet fire water system piping condition every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head. The inspection method used shall be capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling. Ensure procedures require a follow-up volumetric wall thickness evaluation where irregularities are detected.

The staff noted that the procedure changes are associated with NFPA 25 Section 14.2, "Internal Inspection of Piping." Although the enhancement is partially consistent with NFPA 14.2 and AMP XI.M27 Table 4a, NFPA 25, Section 14.2.2 requires that the wet pipe system in each building be inspected every 5 years. The staff noted that microbiologically-influenced corrosion (MIC) testing and obstruction investigations are addressed in Enhancements 26 and 25, respectively. During the audit, the staff verified that there is only one wet pipe sprinkler system in each building protected by a wet pipe system. By letter dated October 12, 2016, the staff issued RAI B.1.13-3a requesting that the applicant state whether each building's wet pipe system will be inspected every 5 years.

In its response dated November 10, 2016, the applicant revised Enhancement 2 to state that each building's wet pipe fire water system will be inspected every 5 years.

The staff finds the applicant's response and this enhancement acceptable because the inspections of the wet pipe systems will be consistent with NFPA 25 Section 14.2.2. The staff's concern described in RAI B.1.13-3a is resolved. The staff also finds the enhancement acceptable because the inspection methods will be capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion and corrosion product deposition, and followup volumetric wall thickness evaluation where irregularities are

detected will be conducted as recommended by GALL Report AMP XI.M27, as modified by LR-ISG-2012-02.

Enhancement 3. As amended by letter dated November 10, 2016, LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated it will:

> Revise Fire Water System Program procedures to perform an internal inspection every five years for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head of the dry piping downstream of preaction valves. The inspection shall be performed by opening a flushing connection, removing the most remote sprinkler head, and using a method capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable as described in the above staff evaluation of Exception 6. The staff also finds it acceptable because the inspection methods will be capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion and corrosion product deposition. Although it was not stated in this enhancement that followup volumetric wall thickness will be conducted, it is not anticipated that, with the exception of piping addressed in Enhancement 10, dry piping would experience sufficient wall loss to warrant volumetric inspection.

Enhancement 4. As amended by letter dated November 10, 2016, LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to:

> Revise Fire Water System Program procedures to perform an internal inspection every five years for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head of the dry piping downstream of the automatic deluge valves. The inspection shall be performed by opening a flushing connection, removing the most remote sprinkler head, and using a method capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable as described in the above staff evaluation of Exception 6. The staff also finds it acceptable because the inspection methods will be capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion and corrosion product deposition. Although it was not stated in this enhancement that followup volumetric wall thickness will be conducted, it is not anticipated that, with the exception of piping addressed in Enhancement 10, dry piping would experience sufficient wall loss to warrant volumetric inspections.

Enhancement 5. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire

Water System program procedures to conduct "an inspection of the nozzles associated with the charcoal filters for loss of material and foreign or organic material when the charcoal is replaced." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable, in conjunction with Enhancement 12, because the inspections and tests in these enhancements can ensure that potential flow blockage is detected.

Enhancement 6. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to "inspect the interior of the fire water tanks in accordance with NFPA 25 (2011 Edition), Sections 9.2.6 and 9.2.7, including sub-steps." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with NFPA 25 and AMP XI.M27 Table 4a.

Enhancement 7. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to "remove strainers every 5 years to clean and inspect for damage and corroded parts."

The staff noted that AMP XI.M27, as modified by LR-ISG-2012-02, recommends that strainer inspections be conducted every refueling outage interval or when the system has been actuated. The staff also noted that NFPA 25 Section 10.2.1.7 states that mainline strainers are inspected every 5 years as stated in the enhancement. Subsequent to the issuance of LR-ISG-2012-02, the staff concluded that absent flow in the system, an inspection would not provide an effective indicator of potential flow blockage in the system. By letter dated October 12, 2016, the staff issued RAI B.1.13-3b requesting that the applicant state whether strainers will be inspected whenever the system has been actuated.

In its response dated November 10, 2016, the applicant revised Enhancement 7 to include inspection of strainers after each actuation.

The staff finds the applicant's response and this enhancement acceptable because strainers will be inspected on a set frequency and as event-driven, consistent with AMP XI.M27, as modified by LR-ISG-2012-02. The staff's concern described in RAI B.1.13-3b is resolved.

Enhancement 8. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to "specify that sprinkler heads are tested or replaced in accordance with NFPA-25 (2011 Edition), Section 5.3.1." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with AMP XI.M27 Table 4a.

Enhancement 9. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to "conduct a flow test or flush sufficient to detect potential flow blockage, or conduct 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 in each 5-year interval, beginning 5 years prior to the period of extended operation." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with AMP XI.M27,

as modified by LR-ISG-2012-02, for normally dry but periodically wetted piping segments that cannot be drained.

Enhancement 10. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to:

> [P]erform volumetric wall thickness inspections of 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect each 5-year interval of the period of extended operation. Measurement points shall be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping that is inspected in each 5-year interval is in different locations than previously inspected piping.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with AMP XI.M27, as modified by LR-ISG-2012-02, for normally dry but periodically wetted piping segments that cannot be drained.

Enhancement 11. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to “perform a blockage evaluation if the flowing pressure decreases by more than 10 percent from the original main drain test or previous main drain tests.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with the acceptance criterion in NFPA 25 Section 13.2.5.2 for main drain tests.

Enhancement 12. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to “flow test the charcoal filter unit’s manual deluge valve systems with air on an annual basis to ensure there are no obstructions. If obstructions are found, the system shall be cleaned and retested.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with NFPA 25, which allows testing with air when water could damage downstream equipment, and AMP XI.M27 Table 4a.

Enhancement 13. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to “trip test with flow at least once every 18 months the deluge valve systems for the main turbine lube oil tank and main feedwater pumps. If obstructions are found, the system shall be cleaned and retested.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with NFPA 25 Section 13.4.3.2, which allows this refueling outage interval when the protected equipment could be damaged by water, and AMP XI.M27 Table 4a.

Enhancement 14. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to “open and close hydrant valves slowly while performing flow tests to prevent surges in the system. The program shall also require full opening of the

hydrant valve." During the audit, the staff confirmed that the acceptance criteria for the plant-specific test procedure requires that clear water be discharged from the hydrant before termination of the flush.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because the hydrant testing procedures will be consistent with AMP XI.M27, as modified by LR-ISG-2012-02, and NFPA 25.

Enhancement 15. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to verify that the hydrants drain within 60 minutes after flushing or flow testing. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with NFPA 25 Section 7.3.2.4 and AMP XI.M27 Table 4a.

Enhancement 16. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to, "perform vacuum box testing on the bottom of the tank to identify leaks. In the event the bottom of the fire water tank is uneven, the station will perform a suitable NDE technique rather than vacuum box testing to identify leaks." The staff noted that vacuum box testing is consistent with NFPA 25 Section 9.2.7(6); however, the staff lacks sufficient detail to evaluate, "a suitable NDE technique." By letter dated October 12, 2016, the staff issued RAI B.1.13-3c requesting that the applicant state the specific techniques that will be used as an alternative to vacuum box testing.

In its response dated November 10, 2016, the applicant stated that enhanced visual testing (EVT-1) or UT are examples of methods that could be used to detect cracks on the bottom of the tank. The applicant also stated that the tank level instrumentation alarms in the control room and that there are routine operator observations of the tank and surrounding area.

The staff noted that EPRI TR 1012082, "Materials Reliability Program: Inspection and Flaw Evaluation Strategies for Managing Aging Effects in PWR Internals (MRP-153)," December 2005, Section 4.1, "Visual Examination Demonstration," cites the ability to detect underwater cracks with EVT-1 inspections.

The staff finds the applicant's response and enhancement acceptable because inspection methods have been cited by the applicant that are capable of detecting cracks in the tank bottom. In addition, level alarms and operator observations are also an effective means to detect potential leakage. The staff's concern described in RAI B.1.13-3c is resolved.

Enhancement 17. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will "[r]evise its Fire Water System Program procedures to ensure the training and qualification of the individual performing the evaluation of fire water storage tank coating degradation is in accordance with ASTM International standards endorsed in RG 1.54, including limitations, if any, identified in RG 1.54 on a particular standard." The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because the staff has endorsed ASTM standards for personnel evaluating coating inspection results in RG 1.54.

Enhancement 18. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to perform wet sponge and dry film testing on the coating applied to the interior of the fire water tanks. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because tests of this nature are recommended in AMP XI.M27, as cited by reference to NFPA 25 Sections 9.2.6 and 9.2.7.

Enhancement 19. As amended by letter dated January 16, 2017, Enhancement 19 was deleted. The original enhancement stated:

> [C]onduct augmented flow tests or flushing and wall thickness measurements for fire water piping experiencing recurring internal corrosion prior to the period of extended operation and at least once every 5 years during the period of extended operation. Procedures shall be revised to require wall thickness measurements at selected locations that provide a representative sample of the type of piping and environment where the recurring corrosion is occurring. The procedure should allow for selected grid locations to change based on the relevance and usefulness of the wall thickness measurements.

The staff noted that the enhancement lacked sufficient detail for the staff to evaluate the effectiveness of managing recurring internal corrosion. By letter dated October 12, 2016, the staff issued RAI B.1.13-3, part (d), requesting that the applicant state whether wall thickness measurements will be conducted in addition to flow tests and flushes or in addition to only flushes. The RAI part (d) also requests that the applicant state: (a) the minimum number of inspections that will occur in each 5-year interval; (b) the criteria to be used to determine that additional inspections are warranted (e.g., extent of degradation at individual corrosion sites, rate of degradation change, trend of through-wall leaks); (c) how inspections of components that are not easily accessed will be conducted; (d) how leaks in buried or underground piping will be detected; and (e) how many additional inspections will be conducted within an inspection interval when through-wall leakage is detected or inspection results reveal pipe wall thickness below minimum wall. In addition, Enhancement 19 is not consistent with LRA Section 3.3.2.2.8, which states that the Fire Water System program "will conduct augmented flow tests or flushing, and wall thickness measurements for fire water piping experiencing recurring internal corrosion prior to the period of extended operation and at least once every refueling cycle during the period of extended operation."

The staff noted that the applicant's response, below, was not responsive to the following sub parts of the RAI part (d): (a) the minimum number of inspections that will occur in each 5-year interval, because the minimum number of inspections was not stated, (b) the criteria to be used to determine that additional inspections are warranted, because the response simply repeated back the considerations cited in the RAI and did not provide the criteria, and (e) how many additional inspections will be conducted within an inspection interval when through-wall leakage is detected or inspection results reveal pipe wall thickness below minimum wall because the number of inspections was not stated.

In its response dated November 10, 2016, the applicant stated: "[t]he evaluation of inaccessible areas in any system is based on the inspection of accessible areas. Leaks in the fire water system, including underground leaks, are detected by system walkdowns, monitoring jockey pump operating time, and monitoring fire water tank level via alarm in the control room." The applicant resolved the internal discrepancy between the enhancement to the program and the

further evaluation by revising this enhancement to be consistent with the further evaluation, which cited more frequent inspections.

The staff finds the applicant’s response to subparts (c) and (d) acceptable because the three proposed monitoring techniques can be effective at detecting leaks from inaccessible piping. The staff notes that monitoring jockey pump operating time can be very effective at identifying leaks because it provides quantitative trending results. By letter dated December 2, 2016, the staff issued RAI B.1.13-3d(a) requesting that the applicant respond to subparts (a), (b), and (e) in the original RAI B.1.13-3 part (d).

In its response dated January 16, 2017, the applicant stated that upon reevaluation of the plant-specific operating experience data: (a) only two occurrences involved fire protection piping subject to an AMR; (b) the two occurrences were in 2004; (c) in one of the two occurrences, the piping remained at a thickness greater than 50 percent nominal wall thickness; and (d) an additional review of fire water system CRs issued between January 1, 2014, and December 16, 2016, did not identify any additional occurrences of internal corrosion on in-scope fire water system piping. The applicant also stated that the source of water for the fire water system is the potable water system, which does not promote an inordinate extent of corrosion. The applicant further stated that, “[t]he inspections described in LRA Section B.1.13 will result in twenty-six (26) new inspections every 5 years.”

The staff noted that a review of the Audit Report for the fire water system revealed that there were five leaks in the fire water system from 2004 to 2012. This does not reach the threshold for managing loss of material due to recurring internal corrosion.

The staff finds the applicant’s response to RAI 1.13-3 part (d) and RAI 1.13-3d(a) acceptable because: (a) plant-specific operating experience does not meet the threshold for managing loss of material due to recurring internal corrosion; (b) potable water is a less aggressive environment than raw water; and (c) given the plant-specific operating experience, conducting 26 internal inspections every 5 years provides adequate insight into the internal conditions of the fire water system. The staff’s concerns described in RAIs B.1.13-3 part (d) and B.1.13-3d(a) are resolved.

Enhancement 20. LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to:

> [E]nsure a fire water tank is not returned to service after identifying interior coating blistering, delamination or peeling unless there are only a few small intact blisters surrounded by coating bonded to the substrate as determined by a qualified coating inspector, or the following actions are performed: (a) any blistering in excess of a few small intact blisters or blistering not completely surrounded by coating bonded to the substrate is removed; (b) any delaminated or peeled coating is removed; (c) the exposed underlying coating is verified to be securely bonded to the substrate as determined by an adhesion test endorsed by RG 1.54 at a minimum of three locations; (d) the outermost coating is feathered and the remaining outermost coating is determined to be securely bonded to the coating below via an adhesion test endorsed by RG 1.54 at a minimum of three locations adjacent to the defective area; (e) ultrasonic testing is performed where there is evidence of pitting or corrosion to ensure the tank meets minimum wall thickness requirements; (f) an evaluation is performed to ensure downstream

flow blockage is not a concern; and (g) a followup inspection is scheduled to be performed within two years and every two years after that until the coating is repaired, replaced, or removed.

The staff noted that the "acceptance criteria" program element of AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," recommends that blister size and frequency should not be increasing between inspections. The size and frequency of blisters is addressed in Enhancement 22 to the "acceptance criteria" program element. However, Enhancement 20 would allow the return of a fire water storage tank to service without the above-cited corrective actions even if small blisters were increasing in size or frequency. In addition, the enhancement allows a coating inspector rather than a coating specialist to evaluate the conditions for use of the alternative. By letter dated October 12, 2016, the staff issued RAI B.1.13-3 part (e) requesting that the applicant state the basis for using: (a) the return-to-service alternative even though the size and frequency of blisters could be increasing; and (b) a coating inspector rather than a coating specialist to evaluate the conditions for use of the alternative.

In its response dated November 10, 2016, the applicant revised the enhancement to state that a coatings specialist will evaluate the conditions for use of the alternative and the alternative will not be used if the size or number of small intact blisters surrounded by coating bonded to the substrate is increasing.

The staff finds the applicant's response and enhancement acceptable because the provisions for returning a fire water tank to service after identifying interior coating blistering, delamination, or peeling is consistent with GALL Report AMP XI.M42. The staff's concern described in RAI B.1.13-3 part (e) is resolved.

Enhancement 21. LRA Section B.1.13 includes an enhancement to the "detection of aging effects" program element. The staff's evaluation of this enhancement is documented above in Exception 5.

Enhancement 22. LRA Section B.1.13 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to incorporate acceptance criteria identical to recommendations (a), (b), (c), and (e) in the "acceptance criteria" program element of AMP XI.M42. Recommendation (d) is not applicable because the applicant does not have cementitious coatings inside its fire water storage tank. The applicant additionally stated that it would "[q]uantify the ability of the coating adhesion to meet the plant-specific design requirements specific to the coating/lining substrate for the fire water tanks based on visual inspections, wet sponge testing, or dry film testing." It is not clear to the staff how quantitative adhesion results would be obtained from "visual inspections, wet sponge testing, or dry film testing." By letter dated October 12, 2016, the staff issued RAI B.1.13-4 requesting that the applicant state what method(s) will be used to quantify adhesion results.

In its response dated November 10, 2016, the applicant revised the enhancement to remove the provision to use visual inspections, wet sponge testing, or dry film testing. In its place, the enhancement states "[w]hen conducting adhesion testing, results meet or exceed the degree of adhesion recommended in plant-specific design requirements specific to the coating/lining and substrate."

The staff finds the applicant’s response and enhancement acceptable because all of the acceptance criteria are consistent with the acceptance criteria of GALL Report AMP XI.M42. The staff’s concern described in RAI B.1.13-4 is resolved.

Enhancement 23. LRA Section B.1.13 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to “include acceptance criteria of no abnormal debris (i.e., no corrosion products that could impede flow or cause downstream components to become clogged). Any signs of abnormal corrosion or blockage will be removed, its source and extent of condition determined and corrected, and entered into the corrective action program.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with the acceptance criteria of part (c) in AMP XI.M27.

Enhancement 24. LRA Section B.1.13 includes an enhancement to the “corrective actions” program element. In this enhancement, the applicant stated that [it will revise its Fire Water System program procedures to specify “replacement of any sprinkler heads that show signs of leakage, excessive loading, corrosion, or loss of fluid in the glass bulb heat responsive element.” The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with the criteria in NFPA 25 Section 5.2.1.1.2 associated with aging effects.

Enhancement 25. LRA Section B.1.13 includes an enhancement to the “corrective actions” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to:

> [P]erform an obstruction evaluation if any of the following conditions exist: (a) there is an excessive discharge of material during routine flow tests; (b) an inspector's test valve is clogged during routine testing; (c) foreign materials are identified during internal inspections; (d) sprinkler heads are found clogged during removal or testing; (e) pin hole leaks are identified in fire water piping; (f) after an extended fire water system shutdown (greater than one year); (g) there is a 50% increase in time it takes for water to flow out the inspector test valve after the associated dry valve is tripped when compared to the original acceptance criteria or last test.

The staff noted that the applicant used the term “excessive” in relation to the discharge of material during routine flow tests. The staff also noted that NFPA 25 Section 14.3.1 uses the term “obstructive.” The term “excessive” is not defined; therefore, the staff could not complete its evaluation of this enhancement. By letter dated October 12, 2016, the staff issued RAI B.1.13-5 requesting that the applicant state the criteria for determining that the presence of material in the discharge from flow tests is excessive.

In its response dated November 10, 2016, the applicant changed the term “excessive” to “obstructive.”

The staff finds the applicant’s response and enhancement acceptable because the criteria used to conduct an obstruction evaluation are consistent with those conditions in NFPA 25 Section 14.3, “Obstruction Investigation and Prevention,” related to age-related flow blockage issues. The staff’s concern described in RAI B.1.13-5 is resolved.

Enhancement 26. LRA Section B.1.13 includes an enhancement to the “corrective actions” program element. In this enhancement, the applicant stated that it will revise its Fire Water System program procedures to evaluate for MIC if tubercules or slime are identified during any internal inspections of fire water piping. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because it is consistent with NFPA 25 Section 14.2.1.2.

Enhancement 27. As amended by letter dated November 10, 2016, LRA Section B.1.13 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it will perform preaction valve trip testing every 3 years with the manual isolation valve closed.

The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M27, as modified by LR-ISG-2012-02, and finds it acceptable because although trip testing is cited in NFPA 25, the test is used to demonstrate an active function of the valve and is therefore not within the scope of AMP XI.M27.

Based on its audit, and review of the applicant’s responses to RAIs B.1.13-1, B.1.13-2, B.1.13-3 (parts a through e), B.1.13-3d(a), B.1.13-4, and B.1.13-5, 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, as modified by LR-ISG-2012-02. 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 “detection of aging effects,” “acceptance criteria,” 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.1.13 summarizes operating experience related to the Fire Water System program. The applicant cited examples of plant-specific operating experience associated with minor leaks in 2011 and 2012. The applicant also cited an example in 2013, where a water flow test for a start-up transformer identified a clogged spray nozzle. These degraded conditions were entered into the work control system for correction.

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.

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.M27 and evaluation of recurring internal corrosion, as modified by LR-ISG-2012-02 were evaluated.

FSAR Supplement. As amended by letter dated November 10, 2016, LRA Section A.1.13 provides the FSAR supplement for the Fire Water System program. The staff reviewed this

FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1 of LR-ISG-2012-02 and LR-ISG-2013-01, and noted that certain aspects of the recommended FSAR supplement content were not included. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information into its FSAR supplement. By letter dated October 12, 2016, the staff issued RAI B.1.13-6 requesting that the applicant state the basis for not including the following in the FSAR supplement: (a) the program manages the aging effects through the use of flow testing and visual inspections performed in accordance with the 2011 Edition of NFPA 25; and (b) the water-based fire protection system is normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

In its response dated November 10, 2016, the applicant revised LRA Section A.1.13 to include the two provisions discussed in the RAI. The applicant also updated the individual enhancements listed in the FSAR supplement to reflect the changes described in the response to the above RAIs.

The staff finds the applicant’s response acceptable because by adding the statements related to use of the 2011 Edition of NFPA 25 and system pressure monitoring, the FSAR description is consistent with SRP-LR Table 3.0-1 as modified by LR-ISG-2012-02. Therefore, the FSAR supplement for the Fire Water System program is consistent with the corresponding program description in SRP-LR Table 3.0-1 for both LR-ISG-2012-02 and LR-ISG-2013-01. The staff’s concern described in RAI B.1.13-6 is resolved.

The staff noted that LRA Section A.1.13 was revised by letter dated January 16, 2017, to remove the wording associated with managing recurring internal corrosion. The staff’s evaluation of not addressing loss of material due to recurring internal corrosion is documented in Enhancement 19. The staff also noted that the applicant committed to enhance the program as described in the above enhancements prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later (commitment no. 10 as listed in Appendix A).

The staff finds that the information in the FSAR supplement, as amended by letters dated November 10, 2016, and January 16, 2017, is an adequate summary description of the program.

Conclusion. Based on 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 the corresponding program elements of GALL Report AMP XI.M27, as modified by LR-ISG-2012-02. 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. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Flow-Accelerated Corrosion

Summary of Technical Information in the Application. LRA Section B.1.14 describes the existing Flow-Accelerated Corrosion program as consistent, with enhancements, with GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," as modified by LR-ISG-2012-01, "Wall Thinning Due to Erosion Mechanisms." The LRA states that the AMP manages loss of material caused by flow-accelerated corrosion in carbon steel components using the guidelines published by EPRI in NSAC-202L, Revision 3, "Recommendations of an Effective Flow-Accelerated Corrosion Program." The program determines susceptible systems, predicts wall thinning based on analyses of computer models, performs wall thickness measurements on representative samples to confirm predictions and plan long-term corrective actions, and evaluates the measurement results to recalibrate the predictive models. The LRA also states that the program manages wall thinning due to erosion mechanisms based on industry and plant-specific operating experience.

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 7 of the applicant's program to the corresponding program elements of GALL Report AMP XI.M17. The staff also reviewed the portions of the "scope of program," "detection of aging effects," "monitoring and trending," and "corrective actions" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.14 includes an enhancement to the "scope of program," "detection of aging effects," and "monitoring and trending" program elements. For this enhancement, the applicant will revise its program procedures to also manage wall thinning due to erosion mechanisms. The applicant will include susceptible locations based on plant-specific or industry operating experience and will ensure that any replaced components subject to erosive conditions will not be excluded from inspections or inspections will continue until the effectiveness of the corrective action is assured. The staff reviewed this enhancement against the corresponding program elements in LR-ISG-2012-01 and finds it acceptable because when it is implemented the program will manage loss of material due to erosion mechanisms by measuring wall thickness at susceptible locations and will ensure that inspections will continue until the effectiveness of any corresponding corrective actions are assured.

Enhancement 2. LRA Section B.1.14 includes an enhancement to the "corrective actions" program element. For this enhancement, the applicant will revise its program procedures to evaluate wall thinning due to erosion when determining a type of replacement material. The staff notes that this consideration is necessary because unlike flow-accelerated corrosion, erosion mechanism may not be resolved through the use of materials having low chromium content. The staff reviewed this enhancement against the corresponding program element in LR-ISG-2012-01 and finds it acceptable because when it is implemented the program will consider erosion when a replacement material type is determined.

Based on its audit, the staff finds that program elements 1 through 7 for which the applicant claimed consistency with the GALL Report are consistent with the corresponding program elements of GALL Report AMP XI.M17, as modified by LR-ISG-2012-01. The staff reviewed the enhancements associated with the "scope of program," "detection of aging effects," "monitoring and trending," and "corrective action" program elements and finds that, when implemented, they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.14 summarizes operating experience related to the Flow-Accelerated Corrosion program. The LRA described an instance in which the wall thickness of a feedwater and heater drain line was projected to less than the critical wall thickness prior to the next outage. In that case, the applicant removed conservatisms in the critical wall thickness value and determined that the component's wear was not significant. The LRA described another instance where the applicant found the wall thickness for an extraction steam pipe to be less than the critical value and performed a weld overlay to allow operation until the next opportunity for replacement. The applicant also expanded the inspection scope to include similar components in similar configurations.

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 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.

FSAR Supplement. LRA Section A.1.14 provides the FSAR supplement for the Flow-Accelerated Corrosion program. The staff reviewed this FSAR 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 also noted that the applicant committed to implement the enhancements to the program, as described in LRA Section B.1.14, prior to June 18, 2024 (commitment no. 11 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Flow-Accelerated Corrosion 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.M17. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Inservice Inspection – IWF

Summary of Technical Information in the Application. LRA Section B.1.16 describes the existing Inservice Inspection – IWF program as consistent with enhancements, with GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF." The LRA states that the AMP performs periodic visual examinations of ASME Class 1, 2, and 3 piping and component supports to determine their mechanical/structural condition or degradation. The program includes "verification of clearances, settings and physical displacements for loose or missing

parts, debris, corrosion, wear, erosion, or the loss of integrity of welded or bolted connections." The LRA also states that WF3 uses a free-standing SCV and does not have MC piping and component supports. The program is implemented through plant procedures that fulfill the requirements of ASME Code Section XI in accordance with 10 CFR 50.55a.

The LRA states that "[t]he ISI-IWF Program includes provisions to ensure that the selection of bolting material, installation torque or tension, and the use of lubricants and sealants are appropriate for the intended purpose." As such, implementing procedures use recommendations delineated in NUREG–1339, EPRI NP-5769, NP-5067, and TR-104213 for the proper specification of bolting material, lubricant, and installation torque. The LRA also states that plant procedures prohibit the use of lubricants that contain MoS_2 and, because of this, the applicant claims that SCC for high-strength structural bolting material is not plausible.

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," "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 "preventive actions" program element in GALL Report AMP XI.S3 recommends that selection of bolting material and the use of lubricants and sealants is in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG–1339 to prevent or mitigate degradation and failure of safety-related bolting. However, during its audit, the staff found that the applicant's "preventive actions" program element of the ISI-IWF AMP basis document states:

> The program is a condition monitoring program and does not include guidance for the selection of bolting material, installation torque or tension, and use of lubricants and sealants. The program is supplemented by existing plant procedures to ensure that the selection of bolting material installation torque or tension, and the use of lubricants and sealants is appropriate for the intended purpose. These procedures use the guidance contained in NUREG–1339 and in EPRI NP-5769, NP-5067, and TR-104213 to ensure proper specification of bolting material, lubricant, and installation torque.

It was not clear to the staff if the above statements in the "preventive actions" program element discussed in the AMP basis document are consistent with those of the GALL Report AMP XI.S3, because (1) the statement indicates that there are plant procedures that supplement an existing Code-based condition monitoring (only) program, and (2) the staff was unable to identify a link between the audited AMP implementing procedure(s) and the existing plant supplemental procedure(s) (discussed in the applicant's quote above) being credited. The staff identified that this issue also applies to the applicant's Containment Inservice Inspection – IWE program, presented in LRA Section B.1.6, evaluated in SER Section 3.0.3.2.4. Therefore, by letter dated September 15, 2016, the staff issued RAI B.1.6-1 requesting that the applicant clarify how the "preventive actions" program element in LRA AMP B.1.6 is consistent with the GALL Report AMP XI.S1 (and in this case AMP XI.S3) with regard to supplemental preventive actions for selection of bolting material installation torque or tension and the use of lubricants and sealants in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and the additional recommendations of NUREG–1339 to prevent or mitigate degradation and failure of structural bolting.

In its response dated October 13, 2016, the applicant stated that multiple WF3 AMPs, including that in LRA Section B.1.16, use in their implementing procedures the guidance contained in NUREG–1339 and in EPRI Report NP-5769, NP-5067, and TR-104213 for selection of bolting material, lubricants and sealants, and installation torque or installation. Therefore, the applicant stated that no additional enhancement is necessary. The applicant further clarified that appropriate sections of the WF3 AMP basis document have been revised to indicate consistency of the AMP with relevant GALL Report discussions related to high-strength bolting. The staff's evaluation of the applicant's response to RAI B.1.6-1 is documented in SER Section 3.0.3.2.4, "Containment Inservice Inspection – IWE."

The staff finds the applicant's response acceptable because the applicant confirmed consistency of the "preventive actions" program element of LRA AMP B.1.16 with the GALL Report AMP XI.S3 regarding the selection and installation of bolting material, including the use of lubricants and sealants to prevent or mitigate degradation and failure of safety-related bolting (1) by clarifying that the program already implements, through existing procedures, the guidance contained in NUREG–1339 and in EPRI Report NP-5769, NP-5067, and TR-104213; and (2) by revising applicable sections of the AMP basis document to indicate the link between the AMP and its existing implementing plant procedures for the above-mentioned preventive actions. The staff's concern described in RAI B.1.6-1 is resolved.

The "parameters monitored or inspected" program element in GALL Report AMP XI.S3 recommends that the program monitor high-strength structural bolting susceptible to SCC. In addition, the "detection of aging effects" program element recommends that to detect cracking in high-strength bolts, VT-3 visual examinations be supplemented with volumetric examinations. The GALL Report states that volumetric examinations may be waived with an adequate plant-specific justification. Additionally, the "preventive actions" program element recommends (1) the use of bolting material that has an actual measured yield strength less than 150 ksi, and (2) prohibition of the use of MoS_2 as a thread lubricant." In addressing the potential for SCC of high-strength bolting for the ISI – IWF program, LRA Section B.1.16 states:

> [P]lant procedures prohibit the use of lubricants containing molybdenum disulfide [MoS_2]. Since the use of this type of lubricant is prohibited in plant procedures and plant procedures provide the technical guidance for installation requirements […], stress corrosion cracking for high-strength structural bolting material, i.e., ASTM A325 and A490, is not plausible.

The staff noted that while the GALL Report specifically states that the use of MoS_2 lubricant is a potential contributor to SCC in high-strength bolts, the GALL Report does not limit MoS_2 thread lubricant as the only potential contributor to cracking due to SCC. The staff determined that a justification to waive volumetric examinations of high-strength bolts based solely on the prohibition of the use of MoS_2 lubricants does not sufficiently address the potential for SCC for high-strength bolting. In addition, the staff found during its onsite audit that the ISI-IWF AMP basis document did not discuss whether the program will specify the use of bolting material with an actual measured yield strength less than 150 ksi, consistent with GALL Report recommendations. Therefore, by letter dated October 12, 2016, the staff issued RAI B.1.16-1, requesting that the applicant state whether high-strength structural bolts are included within the scope of the LRA AMP B.1.16 and, if so, how the effects of age-related degradation (including for bolting material less than 150 ksi) will be managed consistent with the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements of the GALL Report.

In its response dated January 9, 2017, the applicant stated that there are no high-strength structural bolts with actual measured yield strength greater than or equal to 150 ksi in sizes greater than 1-inch diameter within the scope of the Inservice Inspection – IWF program. The applicant also stated that the program procedure indicates that if high-strength bolts are procured in the future, those bolts will be subject to inspection and replacement requirements that address the potential for SCC.

The staff finds the applicant's response acceptable because there are no high-strength bolts greater than 1-inch within the scope of the applicant's Inservice Inspection – IWF program, so the aging effect of cracking due to SCC is not a concern. The staff's concern described in RAI B.1.16-1 is resolved.

The staff also reviewed the portions of the "preventive actions," "detection of aging effects," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.16 includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that it will revise plant procedures to include the preventive actions for storage of ASTM A325, ASTM F1852, and ASTM A490 bolting from Section 2 of RCSC publication, "Specification for Structural Joints Using ASTM A325 or A490 bolts." However, the "preventive actions," program element of the GALL Report AMP XI.S3 recommends the use of the preventive actions for storage, lubricants, and SCC potential discussed in Section 2 of RCSC publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," when structural bolting consists of ASTM A325, ASTM F1852, or ASTM A490 bolts. The staff reviewed this enhancement against the corresponding program element of the GALL Report AMP XI.S3 and noted that the enhancement only included preventive actions for storage of bolting. It did not address the GALL Report recommended preventive actions for lubricants and SCC potential also discussed in Section 2 of the referenced RCSC publication.

The staff noted during its onsite audit that, the ISI – IWF AMP basis document did not fully address preventive actions for lubricants and potential for SCC. The applicant's justification stated that its review of Section 2 of the RCSC publication concluded that the publication only addresses storage; it does not include preventive actions for lubricants and SCC potential for these bolts.

The staff noted that this issue also applied to LRA Section B.1.6 and Section B.1.38, "Structures Monitoring," evaluated in SER Section 3.0.3.2.20. By letter dated September 15, 2016, the staff issued RAI B.1.6-2 regarding this concern for each of these programs, including the ISI – IWF program. The staff's review and resolution of RAI B.1.6-2 are documented in SER Section 3.0.3.2.4. The staff finds the applicant's response acceptable because it clarified that the enhancement to the "preventive actions" program element will supplement existing plant procedures that use the guidance contained in NUREG–1339 and in EPRI Reports NP-5769, NP-5067, and TR-104213 for all structural bolting including ASTM A325, ASTM F1852, and/or ASTM A490 bolts, consistent with the GALL Report recommendation regarding lubricants and the potential for SCC. Therefore, the only enhancement needed for the "preventive actions" program element is to address the storage aspect for these bolts. The staff's concern described in RAI B.1.6-2 is resolved.

Enhancement 2. LRA Section B.1.16 includes an enhancement to the “detection of aging effects,” program element. In this enhancement, the applicant stated that it will revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts and bolts, and cracking of concrete around anchor bolts. The “detection of aging effects” program element of GALL Report AMP XI.S3 recommends anchor bolts to be monitored for loss of material, loose or missing nuts, and cracking of concrete around the anchor bolts. 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 the plant procedures will incorporate the detection of aging effects for anchor bolts, consistent with the recommendations of GALL Report XI.S3.

Enhancement 3. LRA Section B.1.16 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that it will revise plant procedures to specify that the following conditions are unacceptable: loss of material due to corrosion or wear; debris, dirt, or excessive wear that could prevent or restrict sliding of sliding surfaces; and cracked or sheared bolts (including high-strength bolts) and anchors. The “acceptance criteria,” program element of the GALL Report AMP XI.S3 recommends that component supports be examined for loss of material due to corrosion or wear; debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces; cracked or sheared bolts, including high-strength bolts, and anchors. 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 the “acceptance criteria” program element will be consistent with GALL Report AMP XI.S3, when examining acceptance of component supports for all of the aging effects.

Based on its audit, and review of the applicant’s responses to RAIs B.1.6-1, B.1.6-2, and B.1.16-1, 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 actions,” “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.

<u>Operating Experience</u>. LRA Section B.1.16 summarizes operating experience related to the ISI – IWF program. The LRA describes several instances of age-related degraded conditions that the applicant found and evaluated or repaired. During the April 2014 refueling outage, a CCW rigid restraint was found to have a corroded base plate support and the applicant replaced the base plate. An additional example of operating experience provided in the LRA is that several types of damage were found on two SG feedwater lines (e.g., a jam nut that was loose and a hanger rod lacked full engagement, a crack approximately 3 to 4 inches in length in a base plate weld of a trunnion, and a rod that attaches to a pipe clamp was severed). An engineering evaluation analyzed the effect of the damaged supports and determined that allowable stresses were not exceeded and that the feedwater lines remained capable of performing their intended functions.

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.

LRA Section B.1.16 states: "[p]lant procedures prohibit the use of lubricants containing molybdenum disulfide [MoS_2]." During its onsite audit, the staff confirmed that the plant bolting procedures had been revised to prohibit the use of MoS_2; however, it was not clear whether MoS_2 lubricants were used at WF3 before the revision. Therefore, by letter dated September 15, 2016, the staff issued RAI B.1.1-2, requesting that the applicant state whether MoS_2 lubricants have been used on any high-strength structural bolts in sizes greater than 1-inch nominal diameter. In its response, dated October 13, 2016, the applicant stated that it reviewed site documentation and operating experience and determined that MoS_2 has not been used on high-strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1-inch nominal diameter. The staff finds the applicant's response acceptable because it confirmed that MoS_2 has not been used thus far and will not be used in the future. The staff's concern discussed in RAI B.1.1-2 about high-strength structural bolting within the scope of the ISI – IWF program is resolved. The staff's review, evaluation, and resolution of RAI B.1.1-2 is in SER Section 3.0.3.2.1, "Bolting Integrity," and SER Section 3.0.3.2.20, "Structures Monitoring," to the extent applicable.

The ISI-IWF AMP basis document states in the "monitoring and trending" program element that examinations that reveal indications which exceed the acceptance standards and require corrective measures are extended to include additional examinations in accordance with the ASME Code Section XI, Subsection IWF-2430. In addition, ASME Code Section XI, Subsection IWF-2420, "Successive Inspections," states that to the extent practical, the same supports selected for examination during the first inspection interval shall be examined during each successive inspection interval. During its onsite review of the operating experience for component supports, the staff noted:

(1) During the IWF sampling inspections, degraded conditions for component supports were identified that were "acceptable-as-is," consistent with the threshold criteria described in Subsection IWF-3400, "Acceptance Criteria," of ASME Code Section XI. These components were selectively reworked/repaired to as-new condition or replaced. Because the degradation did not meet the ASME Code Section XI thresholds, the applicant determined that the actions associated with Subsections IWF-2420 and IWF-2430 were not required and thus did not apply those Code provisions.

(2) Degraded component supports were identified and reworked/repaired or replaced as the result of walkdowns or other activities, not because of the requirements of ASME Code Section XI, Subsection IWF. However, the staff did not find evidence of an evaluation to determine whether the repaired component supports were included in the IWF sample, which is periodically inspected by the ISI – IWF AMP program. The applicant indicated during the audit that such a process to identify whether repaired component supports are within the IWF inspection sample (i.e., the sample established by ASME Code Section XI, Subsection IWF) may not exist.

The staff was concerned that given that the applicant's ISI-IWF AMP is a sampling program to manage the entire ASME Code component support population, any sampled support that is reworked to as-new condition or replaced, would no longer be representative of other supports in the ISI-IWF component support population. Subsequent ISI-IWF inspections of the same sample may not represent the age-related degradation of the remaining population of supports that are not inspected. It was not clear to the staff whether current processes considered the need for an expansion or a change of the ASME-based ISI-IWF sample, when component

supports within the IWF sample were selectively reworked or replaced. In addition, it was not clear whether a reworked component support whose degradation was identified by other means other than the ISI-IWF inspection (e.g., walkdowns or another program) would continue to be included in the periodically inspected sample. Therefore, by letter dated October 12, 2016, the staff issued RAI B.1.16-2 requesting that the applicant describe, for situations in which inspected components under the ASME Code-based ISI-IWF sample are reworked such that they no longer represent age-related degradation of the entire population, how the ISI-IWF AMP will continue to be effective in managing the aging effects of similar/adjacent components not included in the IWF inspection sample.

By letter dated December 12, 2016, the applicant responded to RAI B.1.16-2 and stated that the "monitoring and trending" program element will be enhanced to include assessment of the impact on the inspection sample representativeness, if components that are part of the sample are reworked. The staff reviewed this enhancement and finds it acceptable because requiring an assessment of the sample population when a sample component is reworked provides reasonable assurance that the inspection sample is representative of the age-related degradation of the total population of component supports. The staff's concern in RAI B.1.16-2 is resolved.

Based on its audit and review of the application, and review of the applicant's responses to RAIs B.1.1-2 and B.1.16-2, 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.S3 was evaluated.

FSAR Supplement. LRA Section A.1.16 provides the FSAR supplement for the ISI – IWF program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. In response to RAI B.1.16-2, by letter dated December 12, 2016, the applicant supplemented LRA Section A.1.16 to state that it will revise plant procedures to include assessment of the inspection sample representativeness if components that are part of the sample population are reworked. The staff's discussion of RAI B.1.16-2 is documented above. The staff also noted that the applicant committed to implement the enhancements to the program stated in LRA Section B.1.16 prior to June 18, 2024 (commitment no. 12 as listed in Appendix A). The staff finds that the information in the FSAR supplement, as amended by letter dated December 12, 2016, is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Inservice Inspection – IWF program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Technical Information in the Application. LRA Section B.1.17 describes the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program as consistent, with enhancements, with GALL Report AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems." The LRA states that the existing program performs periodic visual inspections and preventive maintenance to manage the effects of aging for loss of material due to corrosion, loose bolting or rivets, and rail wear of cranes and hoists within the scope of license renewal and subject to an AMR. The LRA also states that visual examinations and functional testing ensure cranes and hoists are capable of sustaining their rated loads. Although functional testing of active crane components ensures proper functionality, it is not credited for managing the effects of aging for passive components of cranes and hoists. The LRA further states that the scope of program encompasses structural components, including structural bolting, associated with the bridge, the trolley, crane rails; and cranes and hoists that meet the provisions of 10 CFR 54.4(a)(1) and (a)(2) and NUREG–0612, "Control of Heavy Loads at Nuclear Power Plants." The LRA also states that "the aging management activities specified in this program will utilize the guidance provided in ASME Safety Standard B30.2, 'Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist).'"

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 "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. In addition, the staff reviewed portions of the "corrective actions" program element associated with Enhancement 4. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.17 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that it plans to revise plant procedures to specify the monitoring of (1) rails in the rail system for loss of material due to wear; (2) structural components of the bridge, trolley, and hoists for deformation, cracking, and loss of material due to corrosion; and (3) structural connections for loose or missing bolts, nuts, pins, or rivets and any other conditions indicative of loss of bolting integrity. The "parameters monitored or inspected" program element of the GALL Report AMP XI.M23 recommends the use of visual inspections to monitor surface conditions to verify that loss of material is not occurring due to corrosion or wear and to monitor bolted connections for loose bolts, missing or loose nuts, and other conditions indicative of loss of preload. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M23 and finds it acceptable because when it is implemented it will monitor surfaces for loss of material due to corrosion, wear, and bolting for loose bolts or nuts, missing nuts, and other conditions indicative of loss of preload. In addition to the recommendations of the GALL Report, the program is further enhanced to monitor deformation and cracking of rail system structural components. The staff finds this acceptable because the inclusion of these additional parameters aligns the "parameters monitored or inspected" program element to the recommendations in the "Inspection, Testing and Maintenance" chapter of ASME B30.2. Therefore, deformed, cracked, or corroded members will be monitored and inspected in accordance with the provisions of ASME Safety Standard B30.2 to ensure age-related

degradations are identified prior to the loss of intended function of the monitored and inspected components. Enactment of these activities will make the “parameters monitored or inspected” program element consistent with GALL Report AMP XI.M23.

Enhancement 2. LRA Section B.1.17 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that it plans to “[r]evise plant procedures to specify inspection frequency requirements in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series.” The GALL Report AMP XI.M23 recommends that visual inspections be conducted at a frequency consistent with ASME B30.2 or another appropriate ASME B30 series standard. The staff reviewed this enhancement against the corresponding program element in the GALL Report AMP XI.M23 and finds it acceptable because when it is implemented the frequency of inspections will be in accordance with ASME Safety Standard B30.2, which provides guidance regarding timely periodic inspections of crane SSCs, or will use another applicable ASME B30 standard. Enactment of these activities will make the “detection of aging effects” program element consistent with GALL Report AMP XI.M23.

Enhancement 3. LRA Section B.1.17 includes an enhancement to the “acceptance criteria” program element. In this enhancement, the applicant stated that it plans to revise plant procedures to require evaluations for significant loss of material due to wear of rails in the rail system, and for any signs of loss of bolting integrity in accordance with ASME Safety Standard B30.2 or other appropriate standard in the ASME B30 series. The GALL Report AMP XI.M23 recommends visual indications of loss of material due to corrosion or wear and loss of bolting preload to be evaluated in accordance with ASME B30.2 or other applicable ASME B30 series standard. In addition, the GALL Report considers an aging mechanism to be significant when it could potentially result in aging effects that could result in a loss of intended function of a component or structure if allowed to continue without mitigation. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M23 and finds it acceptable because when it is implemented it will ensure that loss of material due to wear in crane rails, and loss of preload in bolted connections, will be evaluated in accordance with applicable ASME B30 series standards. Specifically, ASME Safety Standard B30.2 recommends that conditions disclosed by inspections performed in accordance with the standard, determined to be a hazard to continued operation, shall be corrected by adjustment, repair, or replacement before continuing the use of the crane. Enactment of these activities will make the “acceptance criteria” program element consistent with that of the GALL Report AMP XI.M23.

Enhancement 4. LRA Section B.1.17 includes an enhancement to the “corrective actions” program element. In this enhancement, the applicant stated that plant procedures for maintenance and repairs will be revised to follow the guidance of ASME B30.2 or other appropriate standard in the ASME B30 series. The GALL Report AMP XI.M23 recommends repairs to be performed as specified in ASME B30.2 or other appropriate standards in the ASME B30 series. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M23 and finds it acceptable because when it is implemented it will ensure repairs of scoped-in WF3 cranes will be performed in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. Enactment of these activities will make the “corrective actions” program element consistent with GALL Report AMP XI.M23.

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 "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. Furthermore, the staff finds the enhancement for the "corrective actions" program element to be consistent with program element 7 of GALL Report AMP XI.M23.

Operating Experience. LRA Section B.1.17 summarizes operating experience related to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. Objective evidence that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program will be effective in ensuring that intended functions are maintained consistent with the CLB during the period of extended operation is demonstrated by the following three examples:

(1) The LRA states that in 2011, the applicant identified rust on trolley rail supports of the Turbine Building gantry crane. The condition was addressed and corrected.

(2) The LRA states that a 2009 visual inspection of the trolley and bridge of the FHB crane, identified rust, dirt, and other foreign material on runways. This condition was corrected, following a corrective action to clean the bridge and trolley runways and wipe down the FHB crane.

(3) In addition to the previous two examples, the staff also noted during its onsite audit operating experience review a 2007 CR of a missing bolt in the polar crane. The bolt was replaced and repairs were performed, eliminating any potential future crane loading and fatigue issues.

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 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.

FSAR Supplement. LRA Section A.1.17 provides the FSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1 and noted that it does not address the review and assessment of the number and magnitude of lifts made by the reviewed cranes. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate this information into the LRA FSAR supplement. By letter dated September 15, 2016, the staff issued RAI B.1.17-01 requesting that the applicant rectify this. In its response letter dated October 13, 2016, the applicant stated that the LRA treats crane cycle limits as TLAAs. The evaluation of the crane cycle TLAAs included a review of the number and magnitude of lifts made by hoists or cranes designed to CMAA-70. In addition, the applicant stated that Section 4.7.1, "Crane Load Cycle Analysis," of the LRA and its

FSAR supplement (Section A.2.5.1), discuss the expected number of applicable crane loading (lift) cycles at the end of the period of extended operation to remain below the top of the lowest cyclic loading range in CMAA-70 of 100,000 cycles. The RAI response provided an estimated number of loading (lift) cycles for the polar crane main hook and its auxiliary hook to be 850 and 84,500 lifts, respectively, through the period of extended operation. For the FHB crane main hook, and east and west auxiliary hooks, the estimated number of loading (lift) cycles are 875, 50,000, and 75,000, respectively; all lifts are assumed to be within the crane-rated capacity.

The staff reviewed the applicant's response to RAI B.1.17-01 and noted that the radwaste cask handling bridge crane was omitted from discussion of the loading (lift) cycles. Therefore, by letter dated November 15, 2016, the staff issued a followup RAI B.1.17-02, requesting that the applicant provide the missing loading (lift) cycles for the radwaste cask handling bridge crane. In addition, the staff requested that the applicant state, in LRA Section A.2.5.1, which cranes meet the requirements of the CMAA-70 and which designs remain valid for the period of extended operation. By letter dated January 16, 2017, the applicant revised LRA Section A.2.5.1 and stated that the anticipated number of loading (lift) cycles for the radwaste cask handling bridge crane is 62,400. The staff finds the applicant's responses to RAIs B.1.17 01 and B.1.17-02 acceptable because they provided, consistent with the guidance of the SRP-LR, the requested number of loading (lift) cycles for the in-scope CMAA-70 cranes through the period of extended operation. Moreover, the revised LRA Section A.2.5.1 reflects which cranes meet the regulatory requirements for 10 CFR 54.21(c)(1)(i) through the period of extended operation. The staff's evaluation of the verification and validation of the applicant's responses to RAIs B.1.17-01 and B.1.17-02 are documented in SER Section 4.7.1, "Crane Load Cycle Analysis." The staff's concerns in RAIs B.1.17-01 and B.1.17-02, regarding the loading (lift) cycles and identification of cranes meeting the CMAA-70 requirements in LRA Section A.2.5.1 are resolved. Therefore, the FSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP is consistent with the corresponding program description in SRP-LR Table 3.0-1.

The staff also noted that the applicant committed to revise plant procedures in accordance with ASME Safety Standard B30.2, or other appropriate standard in the ASME B30 series (commitment no. 13 as listed in Appendix A). The procedures will be revised to monitor crane rails for loss of material due to wear; structural components of bridge, trolley, and hoists for deformation, cracking, and loss of material due to corrosion; and structural connections for loose or missing bolts, nuts, pins, or rivets and any other conditions indicative of loss of bolting integrity. Maintenance and repair activities will use the guidance provided in ASME B30.2 or other appropriate standards in the ASME B30 series. The staff also noted that the applicant committed to implement the enhancements prior to June 18, 2024. The staff finds the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report AMP XI.M23, are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Masonry Wall

Summary of Technical Information in the Application. LRA Section B.1.19 describes the existing Masonry Wall program as consistent, with enhancements, with GALL Report AMP XI.S5 "Masonry Walls." The LRA states that the AMP is based on guidance provided in IN 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11," and includes masonry walls required by 10 CFR 50.48, "Fire Protection," and masonry walls with the potential to affect safety-related components. The applicant's review of IE Bulletin 80-11, "Masonry Wall Design," concluded that WF3 does not have seismic Category I masonry walls. The LRA also states that the AMP addresses concrete blocks from masonry walls exposed to an air indoor (uncontrolled) environment to manage the effects of loss of material and cracking, and proposes to manage these aging effects through periodic visual inspections. These inspections will be performed at least once every 5 years to ensure there is no loss of intended function. The aging effects on structural steel components, steel edge supports, and steel bracing of masonry walls will be managed by the Structures Monitoring program, which is evaluated in SER Section 3.0.3.2.20. Masonry walls that are considered fire barriers are also managed by the Fire Protection program, which is evaluated in SER Section 3.0.3.2.8. The staff notes that the applicant's Masonry Wall program is implemented under the same procedure used for the Structures Monitoring 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.S5.

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.1.19 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that plant procedures will be revised to ensure that masonry walls located within in-scope structures are included in the scope of the Masonry Wall program. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S5 and finds it acceptable because when it is implemented it will include all the masonry walls identified as performing intended functions in accordance with 10 CFR 54.4.

Enhancement 2. LRA Section B.1.19 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that plant procedures will be revised to include the monitoring of gaps between the structural steel supports and masonry walls that could potentially affect wall qualification. The staff notes that Enhancement 4 (below) also includes acceptance criteria to ensure that observed conditions do not invalidate the wall's evaluation basis or impact its intended function. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S5 and finds it acceptable because when it is implemented it will ensure that gaps between the supports and masonry walls that could impact the intended function or potentially invalidate the wall's evaluation basis will be monitored, as recommended by the GALL Report.

Enhancement 3. LRA Section B.1.19 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that plant procedures will be revised to specify that masonry walls will be inspected at least once every 5 years with

provisions for more frequent inspections in areas where significant aging effects are observed to ensure no loss of intended function. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S5 and finds it acceptable because when it is implemented it will ensure masonry walls will be inspected every 5 years, with provision for more frequent inspections in areas where significant degradation is observed to ensure there is no loss of intended function between inspections, as recommended by the GALL Report.

Enhancement 4. LRA Section B.1.19 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that plant procedures will be revised to include acceptance criteria to ensure that observed aging effects (i.e., cracking, loss of material, or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S5 and finds it acceptable because when it is implemented it will ensure that the extent of observed shrinkage and/or separation and cracking of masonry does not invalidate the evaluation basis or impact the wall's intended function, as recommended by 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.S5. 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.

Operating Experience. LRA Section B.1.19 summarizes operating experience related to the Masonry Wall 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.

In 1997, during a maintenance rule walkdown, a crack was found in the Turbine Building elevator shaft near the +40 ft. elevation where several joints showed 1/8-inch gap with loss of mortar. This condition was entered into the corrective action program and evaluated by design engineering. The evaluation resolution was to rework the cracks, and it was noted that the cracks do not to impact the Turbine Building's integrity.

In 2004, plant personnel discovered multiple hairline cracks in the concrete block wall at the fire zone RAB 7. The cracks were initially inspected by the fire protection engineer who determined that the current condition does not affect the capability of the walls to perform their fire barrier function. Also, the engineering personnel inspected and evaluated the documented condition and concluded that the cracks do not compromise the structural integrity of the Reactor Auxiliary Building and is acceptable as is.

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 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.

FSAR Supplement. LRA Section A.1.19 provides the FSAR supplement for the Masonry Wall program. The staff reviewed this FSAR 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 Masonry Wall program for managing the effects of aging for applicable components during the period of extended operation (commitment no. 15 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Masonry Wall program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Neutron-Absorbing Material Monitoring

Summary of Technical Information in the Application. LRA Section B.1.21 describes the existing Neutron-Absorbing Material Monitoring program as consistent, with an enhancement, with GALL Report AMP XI.M40, "Monitoring of Neutron-Absorbing Materials Other than Boraflex." The AMP is a condition monitoring program that includes periodic inspection and analysis of test coupons to determine if the neutron-absorbing capability of the material has degraded in a treated water environment. The program ensures that the required 5 percent subcriticality margin is maintained throughout the period of extended operation. The parameters monitored include physical measurements and geometric changes in test coupons. The LRA states that the neutron-absorbing material installed in the spent fuel storage racks is Boral.

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.

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.M40 recommends a frequency of inspection and testing of no more than 10 years. However, during its audit, the staff found that the applicant's Neutron-Absorbing Material Monitoring program did not include the frequency of inspection and testing. By letter dated December 2, 2016 (ADAMS Accession No. ML16335A374), the staff issued RAI B.1.21-1 requesting that the applicant provide a test and inspection frequency and its associated justification.

In its response dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that, consistent with GALL Report AMP XI.M40, the test and inspection frequency is at least once every 10 years.

The staff finds the applicant's response acceptable because it is consistent with GALL Report AMP XI.M40 and coupons pulled from the spent fuel pool in 2009 indicate satisfactory material performance. The staff's concern in RAI B.1.21-1 is resolved.

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.1.21 includes an enhancement to the "monitoring and trending" program element. In this enhancement, the applicant stated that the Neutron-Absorbing Material Monitoring program procedures would be revised to compare measurements from periodic inspections to prior measurements, relate coupon measurement results to the performance of the spent fuel neutron-absorber materials considering differences in exposure conditions, and to ensure the predicted boron-10 areal density will be sufficient to maintain subcritical conditions required by TS until the next coupon test. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M40 and finds it acceptable because when it is implemented it will make the applicant's Neutron-Absorbing Material Monitoring program consistent with GALL Report AMP XI.M40.

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.M40. In addition, the staff reviewed the enhancement associated with the "monitoring and trending" program element and finds that when implemented it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.21 summarizes operating experience related to the Neutron-Absorbing Material Monitoring program.

The applicant provided the following operating experience:

> In 2001, the applicant performed testing of Boral surveillance coupons and visual inspections discovered a uniform oxide film on the front and back surfaces of the coupon. Both sides of the coupon had scratch marks, on which the oxide film had also formed. Black deposits, which appeared to be boron carbide that had broken through the aluminum skin of Boral, were noted on each side of the coupon. These deposits likely formed during hot rolling of Boral to its final plate configuration. No blisters were noted and no blisters developed during elevated temperature drying. The inspection report concluded that these coupons were in good condition and areal density of boron-10 was in excess of design values.
>
> In 2010, the applicant performed testing of Boral surveillance coupons and visual inspections once again discovered that both sides of the coupon were covered by a uniform oxide film. It appeared that some of the oxide was rubbed off during decontamination at Waterford. Approximately 20 tear-shaped discolored areas, each containing a small corrosion pit, were found on the front side of one coupon. Two large corrosion pits and a small blister were observed on the back side. The inspection report concluded that the test results, including

measurement of dimensions, dry weight, and boron-10 areal density, were indicative of satisfactory material performance.

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 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.

FSAR Supplement. LRA Section A.1.21 provides the FSAR supplement for the Neutron- Absorbing Material Monitoring program.

The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1 and noted that LRA Section A.1.21 did not state a test and inspection frequency of at least once every 10 years. The licensing basis for this program for the period of extended operation will be adequate once the applicant incorporates this information into its FSAR supplement. By letter dated December 2, 2016, the staff issued RAI B.1.21-1 requesting that the applicant provide a test and inspection frequency and its associated justification.

In its response dated January 16, 2017 (ADAMS Accession No. ML17016A027), the applicant stated that, consistent with GALL Report AMP XI.M40, the test and inspection frequency is at least once every 10 years. In addition, the applicant has revised LRA Sections A.1.21 and B.1.21 to include the inspection frequency of at least once every 10 years during the period of extended operation.

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Neutron-Absorbing Material Monitoring 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.M40. Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Non-EQ Inaccessible Power Cables (≥ 400 V)

Summary of Technical Information in the Application. LRA Section B.1.24 describes the new "Non-EQ Inaccessible Power Cables (≥ 400 V)" program as consistent, with an exception, with GALL Report AMP XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." As referenced in the LRA, the cables included in AMP B.1.24 are in-scope inaccessible power cables connected to the 480 V electric motor-driven fire pump and the 480 V electric motor-driven jockey fire pump. The AMP proposes to manage inaccessible power cable aging effects through condition monitoring actions (e.g., periodic testing and visual inspections). The LRA states that periodic inspections of the manholes will be performed at least once a year but the applicant took an exception to GALL Report AMP XI.E3 in that the inspection frequency will not be increased by the applicant if water is found in the raceways and manholes during the inspections. Event-driven inspections of manholes for water accumulation are included in the program (e.g., flooding).

The LRA stipulates that for periodic testing, a proven, commercially available test will be used to detect deterioration of the insulation system due to wetting or submergence. Inaccessible electrical cables exposed to significant moisture will be tested at least once every 6 years with the test frequency adjusted based on test results and operating experience. The LRA specifies that one or more tests are to be used to determine the condition of the cables. The first test will be performed 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.E3.

The staff also reviewed the portions of the "preventive actions" program element associated with the noted 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.1.24 includes an exception to the "preventive actions" program element. In this exception, the applicant stated that the "preventive actions" program element is revised to state that the manhole inspection frequency will not be increased if water is found in the manholes during periodic manhole inspections. The applicant further explained that because of the elevation of the plant site and associated manholes, water cannot be prevented from entering the manholes. The applicant concluded that periodic manhole inspections will assess cable and support damage, if any, due to exposure to significant moisture, and periodic testing will provide reasonable assurance that each cable will continue to perform its intended function throughout the period of extended operation. The in-scope inaccessible cables identified by the applicant are the 480 V power cables feeding the electric motor-driven fire pump and electric motor-driven jockey fire pump. These circuits are non-1E, not safety-related.

The "preventive actions" program elements in GALL Report AMP XI.E3 recommend that periodic actions are taken to prevent inaccessible power cables from being exposed to significant moisture, such as identifying and inspecting accessible cable conduit ends and cable manholes for water collection, and draining the water, as needed. GALL Report AMP XI.E3 also recommends that the inspection frequency for water collection is established and performed based on plant-specific operating experience with cable wetting or submergence in manholes (i.e., the inspection is performed periodically based on water accumulation over time), and that if water is found during inspection (i.e., cable exposed to significant moisture), corrective actions are taken to keep the cable dry and to assess cable degradation. GALL

Report AMP XI.E3 also states that when an inaccessible power cable (greater than or equal to 400 V) is exposed to wet, submerged, or other adverse environmental conditions for which it was not designed, an aging effect of reduced insulation resistance may result, causing a decrease in the dielectric strength of the conductor insulation. GALL Report AMP XI.E3 further states that in addition to the necessary periodic actions to minimize the potential for insulation degradation, in-scope power cables exposed to significant moisture are tested to indicate the condition of the conductor insulation (including trending of degradation where applicable). The specific type of test performed is determined prior to the initial test and is a proven test for detecting deterioration of the insulation system due to wetting or submergence.

With the proposed exception to the GALL Report AMP XI.E3, "preventive actions" program element, the staff questioned whether the applicant's Non-EQ Inaccessible Power Cable (≥ 400 V) program would provide adequate aging management of in-scope inaccessible power cables such that both pumps will perform their intended functions during the period of extended operation. The staff noted that without manhole and cable inspections adjusted for water accumulation over time as recommended by GALL Report AMP XI.E3, the in-scope inaccessible power cables may experience increased aging degradation, which could potentially lead to failure of the cables' insulation system.

By letter dated October 12, 2016, the staff issued RAI B.1.24-1 requesting that the applicant demonstrate that with a periodic manhole inspection frequency not adjusted for water accumulation over time, that the in-scope electric motor-driven fire and electric motor-driven jockey fire pump inaccessible power cable aging effects will be adequately managed such that both cables will continue to perform their intended functions during the period of extended operation.

In its response dated November 10, 2016, the applicant noted that in the GALL Report, AMP XI.E3, when an inaccessible power cable (greater than or equal to 400 V) is exposed to wet, submerged, or other adverse environmental conditions, an aging effect of reduced insulation resistance may result, causing a decrease in the dielectric strength of the conductor insulation.

The applicant's response also referenced the program description of GALL Report AMP XI.E3, which recognizes that although periodic actions are taken to prevent cables from being exposed to significant moisture, these actions are not sufficient to demonstrate that water is not trapped elsewhere in the raceway. The applicant, referencing GALL Report AMP XI.E3, stated that therefore, in-scope power cables exposed to significant moisture are tested to indicate the condition of the conductor insulation (including trending where applicable).

The applicant's response also stated that there are no splices in the in-scope 480 V electric-driven fire pump and electric motor-driven jockey fire pump underground cables and there is no history of water treeing in cables that operate at less than 2 kV. Further, the applicant stated that manhole inspections will assess cable and cable support damage, if any, due to exposure to significant moisture, and periodic cable testing will provide reasonable assurance that each cable will continue to perform its intended function during the period of extended operation. Testing of cables exposed to significant moisture will be performed by the applicant at least once every 6 years with test frequencies adjusted based on test results and operating experience.

GALL Report AMP XI.E3 states that periodic actions are necessary to minimize the potential for insulation degradation but recognizes that periodic actions to prevent inaccessible cables from

being exposed to significant moisture are not sufficient to ensure that water is not trapped elsewhere in the raceway. GALL Report AMP XI.E3 also states that a high water table may cause a manhole to refill shortly after purging, and raceway low points may result in long-term submergence such that periodic actions to minimize cable exposure to significant moisture may not be effective. GALL Report AMP XI.E3 further states that in addition to periodic actions, in-scope power cables are tested to assess cable insulation condition. Consistent with the GALL Report, the applicant's program states that testing will be performed at least once every six years and will include a proven test for detecting deterioration of the insulation system due to wetting or submergence. The applicant's LRA states that one or more tests will be used to determine cable condition and will include trending of degradation where applicable. Moreover, consistent with the GALL Report, the applicant's program includes periodic visual inspections performed at least once every year and after event-driven occurrences to assess cable conditions.

The operating history for WF3 cables subject to submergence identified one inservice failure of a 5 kV power cable due to moisture intrusion as discussed in the WF3 response to Generic Letter (GL) 2007-01. Subsequent to GL 2007-01, a plant-specific search did not find any additional cable failures due to age degradation, including in-scope inaccessible cables with license renewal intended functions. The staff noted that the 480 V in-scope electric motor-driven fire pump and electric motor-driven jockey fire pump cables are subject to lower insulation voltage stress compared to medium voltage cable such that electrical stress related failures are not expected to occur (e.g., electrical or water tree degradation). Industry operating experience identifies that low voltage power cable failures have occurred but are more often due to installation and post-installation damage.

The staff finds the applicant's response acceptable because the proposed exception is supported by the applicant's plant-specific operating history that demonstrates the absence of WF3 cable age-related failures attributed to water intrusion. In addition, electrical stress related failures are not expected due to the low voltage stress seen by the electric motor-driven fire pump and electric motor-driven jockey fire pump cables. Further, except for adjusting inspection frequency based on manhole water accumulation over time, the performance of periodic visual inspections and periodic cable testing, trending of cable age degradation as applicable, and the inclusion of event-based inspections to assess cable condition is consistent with the GALL Report. The staff therefore finds that the applicant's Non-EQ Inaccessible Power Cables (≥ 400 V) program will adequately manage the effects of aging on the in-scope electric motor-driven fire pump and electric motor-driven jockey fire pump inaccessible cables such that they will continue to perform their license renewal intended function during the period of extended operation. The staff's concern described in RAI B.1.24-1 is resolved.

The staff reviewed this exception against the corresponding "preventive actions" program element in GALL Report AMP XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and finds it acceptable because the applicant's program, with the proposed exception, will continue to provide adequate aging management for the in-scope electric motor-driven fire pump and jockey fire pump inaccessible cables subject to a plant-specific environment of continuous exposure to significant moisture (submergence).

Operating Experience. LRA Section B.1.24 summarizes operating experience related to the "Non-EQ Inaccessible Power Cables (≥ 400 V)" program. The applicant's search of site- specific operating experience found no aging mechanisms associated with in-scope inaccessible cables not considered in the GALL Report. The program considers the technical information and industry operating experience referenced in GALL Report AMP XI.E3.

The “Non-EQ Inaccessible Power Cables (≥ 400 V)” program is a new program stated to include consideration of industry operating experience when implementing the program and that plant operating experience gained during implementation will be factored into the program through the applicant’s 10 CFR Part 50 Appendix B Quality Assurance program. The LRA referenced the applicant’s response to GL-2007-01, “Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients,” which identified one inservice cable failure attributed to moisture absorption. The LRA identified the cable as a 5 kV EPR insulated cable with 10 to 12 years of service. The failed cable is not within the scope of license renewal. Subsequent to applicant’s response to GL-2007-01, the applicant did not identify any additional cable age-related failures, including any cables with a license renewal 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 review of operating experience, including a sample of CRs, work orders, and inspection reports did not find any significant or unusual operating experience and no previously unknown or recurring aging effects were identified by the applicant or staff. The staff did not identify any plant 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.

FSAR Supplement. LRA Section A.1.24 provides the FSAR supplement for the “Non-EQ Inaccessible Power Cables (≥ 400 V)” program. The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.0-1 and noted that with the applicant’s proposed exception to program element “preventive actions,” the inspection for manhole water collection will not be performed based on plant-specific operating experience with water accumulation over time. Therefore the licensing basis for this program for the period of extended operation may not be adequate if the applicant incorporates this information into its FSAR supplement. By letter dated October 24, 2016, the staff issued RAI B.1.24-1 requesting that the applicant demonstrate that with inspection frequencies not based on water accumulation over time, that the electric motor-driven fire pump and electric motor-driven jockey fire pump cable aging effects will be adequately managed such that both cables will continue to perform their intended functions during the period of extended operation.

As discussed in the staff evaluation section above, the staff reviewed the this exception and the applicant’s RAI response dated November 10, 2016, against the corresponding program elements in the GALL Report and finds it acceptable because in-scope inaccessible cable aging effects will continue to be adequately managed such that both in-scope electric motor-driven fire pump and electric motor-driven jockey fire pump inaccessible cables will continue to perform their intended functions during the period of extended operation.

The staff also noted that the applicant committed to implement the new “Non-EQ Inaccessible Power Cables (≥ 400 V)” program prior to June 18, 2024, or by the end of the last refueling

outage prior to December 18, 2024, whichever is later, for managing the effects of aging of applicable components (commitment no. 19 as listed in Appendix A).

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Non-EQ Inaccessible Power Cables (≥ 400 V) program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and staff-identified differences between the applicant's program and GALL Report XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" program 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Protective Coating Monitoring and Maintenance

Summary of Technical Information in the Application. LRA Section B.1.31 describes the existing Protective Coating Monitoring and Maintenance program as consistent, with an enhancement, with GALL Report AMP XI.S8, "Protective Coating Monitoring and Maintenance Program." The LRA states that the AMP manages the effects of aging on Service Level I coatings applied to external surfaces of carbon steel and concrete inside containment, and that the AMP meets the technical basis of ASTM D 5163-08. The LRA also states that the AMP proposes to assess coating condition through visual inspections by identifying degraded or damaged coatings and providing a means for repair of identified problem areas. The AMP also states that Service Level I protective coatings are not credited to manage the effects of aging and that proper monitoring and maintenance of Service Level I coatings ensures operability of post-accident safety systems that rely on water recycled through containment.

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.

For the "scope of program" and "acceptance criteria" program elements, the staff determined the need for additional information, which resulted in the issuance of RAIs, as discussed below.

The "scope of program" program element in GALL Report AMP XI.S8 recommends that the minimum scope of the program include Service Level I coatings applied to steel and concrete surfaces inside containment to minimize degradation of coatings that can lead to clogging of the emergency core cooling system's suction strainers. However, during its audit, the staff found that the applicant's Protective Coating Monitoring and Maintenance program did not adequately specify the surfaces to be inspected and it was not clear to the staff how failed coatings were addressed in the applicant's inspection program to effectively manage coatings inside containment. By letter dated November 7, 2016 (ADAMS Accession No. ML16307A006), the staff issued RAI B.1.31-1 requesting that the applicant describe the coatings that are included within the scope of inspections consistent with its LRA AMP. The staff requested that the description include a discussion of how inspection findings are used to quantify degraded

coatings, unqualified coatings, and indeterminate coatings for comparison to assumptions in sump screen performance analyses. The RAI also requested that the applicant describe how available margins are adequate to allow for further coating degradation prior to the next inspection.

In its response dated December 7, 2016 (ADAMS Accession No. ML16342C485), the applicant stated that coatings are classified as qualified or unqualified and indeterminate coatings are treated as unqualified coatings. The applicant defined qualified coatings as a coating system used inside the Reactor Containment Building that can be attested to having passed the required laboratory testing to support its use as design basis accident qualified. The applicant also stated that qualified coatings in good condition are presumed to become debris only within the zone of influence, while all unqualified coatings and damaged qualified coatings are presumed to become debris during a LOCA, even when outside the zone of influence.

In its RAI response, the applicant stated that Entergy maintains a log of indeterminate and unqualified coatings and that the total volume of indeterminate and unqualified coatings is included in the total debris generation calculation as contributing to blockage of the safety injection sump. The applicant further quantified the available margin to account for additional degradation of qualified coatings. In 2006, 1,336 sq. ft. of degraded coatings were identified. Inspections between 2006 and 2014, show that the amount of newly identified degraded coatings averaged 32 sq. ft. per refueling cycle. The amount of allowable unqualified coating, as calculated in the total debris generation calculation, is approximately 4,226 sq. ft.

The staff finds the applicant’s response acceptable because it adequately describes the coatings included within the scope of inspections and includes a discussion of how the different categories of coatings are accounted for in the debris generation calculation. The staff’s concern described in RAI B.1.31-1 is resolved.

The “acceptance criteria” program element in GALL Report AMP XI.S8 recommends meeting the technical basis of ASTM D 5163-08 and the use of visual inspections to assess coating condition. In addition, GALL Report AMP XI.S8 also recommends additional ASTM and other recognized test methods, in addition to visual inspections, for use in characterizing the severity of observed coating defects and deficiencies. However, during its audit, the staff found that the applicant’s Protective Coating Monitoring and Maintenance program did not describe additional testing to be performed to characterize severity of degraded coatings. Citing CRs reviewed by the staff during the audit, the staff noted that significant quantities of degraded coatings had been identified by the applicant through visual assessment and that the staff was not able to identify any additional testing performed by the applicant to characterize the identified coating degradation. By letter dated November 7, 2016, the staff issued RAI B.1.31-3 requesting that the applicant describe actions that have been or will be taken to determine the extent of condition, including any physical testing, of coating degradation identified by visual inspection.

In its response dated December 7, 2016, the applicant stated that the cause determination of coating degradation inside containment dates back to the time of plant construction and degraded coating conditions were evaluated and documented at that time. The diagnostic actions beyond visual assessment included dry film thickness measurements, adhesion testing, and in-situ design basis accident testing performed to determine the cause and extent of the degraded coating. The applicant considers the coating degradation identified in the CRs, as mentioned above, to be an ongoing continuation of previously identified coating degradation and because the degradation is typical of previous degradation related to coating issues evaluated during plant construction, no additional testing of these degraded coatings is planned.

Furthermore, the applicant stated that the total identified degraded coating area has ranged from 1,336 to 1,621 sq. ft. between 2006 and 2015, whereas the amount of allowable degradation, as calculated in the total debris generation calculation, is 4,226 sq. ft. The applicant also stated that failed coatings can be replaced or completely removed to ensure that adequate margin is maintained.

The staff finds the applicant's response acceptable because it adequately describes measures taken by the applicant to provide reasonable assurance that the extent of condition has been and will be maintained below the allowable limit. Moreover, the tests performed by the applicant at the time of plant construction and the amount of available margin between identified and allowable coating degradation provide reasonable assurance that coating degradation will be managed to ensure operability of post-accident safety systems that rely on water recycled through containment. The staff's concern described in RAI B.1.31-3 is resolved.

The staff also reviewed the portions of the "detection of aging effects" 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.1.31 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that plant procedures will be revised to specify visual inspections of coatings near sumps or screens associated with the emergency core cooling system. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.S8 and finds it acceptable because when it is implemented it will make the applicant's Protective Coating Monitoring and Maintenance program consistent with GALL Report AMP XI.S8.

Based on its audit, and review of the applicant's responses to RAIs B.1.31-1 and B.1.31-3, 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. In addition, the staff reviewed the enhancement associated with the "detection of aging effects" program element and finds that when implemented it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.31 summarizes operating experience related to the Protective Coating Monitoring and Maintenance program. In 2006, the applicant performed inspections and found coating failures on the steel containment, vessel wall, dome, and polar crane ring girder. The applicant stated that the failure mechanism was splitting of the primer from the topcoat, which left just the base primer on the substrate. The applicant documented these coating failures and determined them to be acceptable. During refueling outages in 2011, 2012, and 2014, the applicant's coating inspections identified slight increases in the amount of coating failures when compared to previous outages. Based on the assumed quantity of failed coating used in the design analysis of the safety injection sump screen, the applicant found the quantities of failed coatings identified during each of the outages to be 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 identified operating experience for which it determined the need for additional clarification and resulted in the issuance of an RAI, as discussed below.

During the audit, the applicant provided information to the staff regarding coating degradation found in containment. The applicant stated that the failure mechanism was splitting of Carboline Carbo Zinc 11 (CZ11) primer, which left only CZ11 primer on the substrate. The staff could not identify any root cause evaluations performed to determine the reason for splitting of the CZ11 primer. By letter dated November 7, 2016, the staff issued RAI B.1.31-2 requesting that the applicant describe actions taken to determine the root cause of the CZ11 primer degradation in containment, including means for ensuring that coatings categorized as qualified are not susceptible to the same failure mechanism.

In its response dated December 7, 2016, the applicant stated that the cause of splitting of the CZ11 primer is believed to be related to coatings issues inside containment that date back to the original construction of WF3. At the time, coating degradation issues were documented as a significant construction deficiency and addressed in WF3 NCRs. The potential causes of the coating problems were identified (e.g., mist layer of coating being applied too thickly that resulted in globules, poor primer batches, and improper QA requirements imposed on coating application). Corrective actions included repair, recoat, and additional inspections and testing (including adhesion testing, dry film thickness measurements, and in-situ design basis accident testing) to assess whether the major portion of the coating on the linear plate was acceptable. The applicant's assessment concluded that the degraded coatings would not affect the WF3 safety injection sump operation, but it could not rule out the potential for isolated areas of future coating degradation. As part of the resolution to the coating issue inside containment, the applicant committed to inspect containment coatings every refueling outage.

The staff finds the applicant's response acceptable because although the assessment could not rule out the potential for isolated areas of future coating degradation, the applicant identified potential causes of the coating degradation at the time of construction, performed an assessment to determine whether the major portion of coating on the liner plate was acceptable, and committed to perform visual inspections every refueling outage to ensure that any additional coating degradation is identified. Furthermore, the applicant has identified corrective actions such as repair, recoating, and removal of degraded coatings to ensure that any identified coating degradation will not exceed the extent of degradation assumed in the safety injection sump performance calculation. The staff's concern described in RAI B.1.31-2 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.1.31-2, 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.S8 was evaluated.

FSAR Supplement. LRA Section A.1.31 provides the FSAR supplement for the Protective Coating Monitoring and Maintenance program.

The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1.

The staff noted that the applicant committed (commitment no. 25 as listed in Appendix A) 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 also noted that the applicant committed to continue inspecting containment coatings every refueling outage to ensure coating degradation (including delamination) will not exceed the extent of degradation assumed in the safety injection sump performance calculation. The applicant committed to implement the enhancement to the program prior to the period of extended operation.

The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Protective Coating Monitoring and Maintenance program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Reactor Head Closure Studs

Summary of Technical Information in the Application. LRA Section B.1.32 describes the existing Reactor Head Closure Studs program as consistent, with enhancements, with GALL Report AMP XI.M3, "Reactor Head Closure Stud Bolting." The technical information the applicant stated in the LRA is summarized as follows.

The program 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 program detects cracking, loss of material, and leakage using visual, surface, and volumetric examinations as required by ASME Code Section XI, Subsection IWB, Table IWB 2500-1.

The methodology for evaluating flaws and acceptance criteria for identified flaws is prescribed in 10 CFR 50.55a, and unacceptable flaws are corrected through implementation of appropriate repair or replacement, as dictated in 10 CFR 50.55a. The "preventive actions" program element of the program is enhanced: (a) to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 ksi, and (b) to exclude the use of MoS_2-containing lubricant.

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.M3. The results of the audit review are documented in the staff's Audit Report.

During the review, the staff noted that the GALL Report guidance recommends yield strength of the bolting materials to be lower than 150 ksi. The staff also noted that this recommendation is related to a threshold susceptibility of higher strength materials to SCC. During the audit, the staff noted that the applicant reviewed the certified material test reports (CMTR) data of the in-scope components and confirmed that the yield strength is below 150 ksi. Therefore, the

staff finds it acceptable because it minimizes any concern of SCC degradation in the closure studs.

Enhancement 1. LRA Section B.1.32 includes an enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that procurement procedures will be revised to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 ksi. The staff reviewed this enhancement and finds it acceptable because it will prevent future procurement of any bolting materials exceeding yield strength of 150 ksi, which will minimize SCC concern.

Enhancement 2. LRA Section B.1.32 includes a second enhancement to the “preventive actions” program element. In this enhancement, the applicant stated that it will revise procedures to exclude the use of MoS_2-containing lubricant. The staff reviewed this enhancement and finds it acceptable because it will, by procedure, prevent the use of disulfide-containing lubricant and therefore, prevent disulfide-induced cracking.

Based on its audit and review, 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.

In addition, the staff reviewed the enhancements associated with the “preventive actions” program element and finds that when implemented they will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.32 summarizes operating experience related to the Reactor Head Closure Studs program. The applicant provided an example related to its plant-specific operating experience. The applicant stated that, during the outage in November 2009, it noticed indications of wastage on the head seating surface between Studs No. 8 and 9. The applicant found that the identified condition resulted from a leak that occurred in 1992. The extent of the corrosion was unchanged from previous observations. No active leak was identified. The vessel head has since been 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 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.

FSAR Supplement. LRA Section A.1.32 provides the FSAR supplement for the Reactor Head Closure Studs program. The staff reviewed this FSAR 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 Studs program during the period of extended operation for managing the effects of aging for applicable

components (commitment no. 26 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Reactor Head Closure Studs program, the staff concludes that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Reactor Vessel Internals

Summary of Technical Information in the Application. LRA Section B.1.33 describes the existing Reactor Vessel Internals program that, when enhanced, will be consistent with GALL Report AMP XI.M16A, "PWR Vessel Internals." The applicant defines this AMP as a sampling-based condition monitoring program that, when implemented, will be used to manage cracking, loss of material due to wear, reduction in fracture toughness, change in dimension, and, for reactor vessel internal components intended to provide core support, loss of preload. The applicant stated that the AMP includes expanding periodic examinations and other inspections, if the extent of the degradation identified exceeds the expected levels.

The applicant stated that this AMP implements the sampling-based condition monitoring process in EPRI TR No. 1022863, "Materials Reliability Program: Pressurized Water Reactor (PWR) Internals Inspection and Evaluation Guidelines" (MRP-227-A), and EPRI TR No. 1016609, "Materials Reliability Program: Inspection Standard for PWR Internals" (MRP-228), as described in the inspection plan submitted to the staff on December 16, 2013. The applicant stated that the process consists of categorizing the RVI components into four sets: (1) a set of "primary" RVI component locations in the plant design that are expected to show leading indications of the degradation; (2) a set of "expansion" RVI component locations that are specified to expand the sample should the indications be more severe than anticipated; (3) a set of RVI component locations that are deemed to be adequately managed by existing programs, such as ASME Code Section XI Examination Category B-N-3, examinations of core support structures; and (4) a set of internal locations that are deemed to require no additional measures. The applicant stated that this process ensures that the intended functions of the RVI components will be maintained during the period of extended operation.

LRA Appendix C provides the applicant responses to those Applicant/Licensee Action Items (A/LAIs) that have been issued on the MRP-227-A methodology.

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.M16A.

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 FSAR indicates that the RVI components at WF3 were designed by Combustion Engineering (CE). The "detection of aging effects" program element in GALL Report AMP XI.M16A, "PWR Vessel Internals," recommends that the inspection guidelines and tables in Chapter 4 of ERPI Report No. 1022863 (MRP-227-A report) be used for inspections of RVI components in PWR-designed nuclear plants. For RVI components of PWRs designed by CE, the MRP-227-A report recommends that the following inspection tables in Chapter 4 of the report be implemented: (a) Table 4-2 for RVI "primary" components, (b) Table 4-5 for RVI "expansion" components, and (c) Table 4-8 for RVI "existing" components. However, during the staff's audit of this AMP, the staff found that the applicant's Reactor Vessel Internals program referenced inspection criteria in Tables 4-3, 4-6, and 4-9 of the MRP-227-A report. The inspection criteria in Tables 4-3, 4-6, and 4-9 apply to RVI components designed by Westinghouse Electric Company, and not those designed by CE.

By letter dated September 15, 2016, the staff issued RAI B.1.33-1, Part 1, requesting that the applicant provide clarification on the specific inspection tables in the MRP-227-A report that will be used to establish the inspection criteria for "primary," "expansion," and "existing program" category RVI components at WF3. Specifically, the staff asked the applicant to clarify whether LRA AMP B.1.33, "Reactor Vessel Internals Program," will implement the inspection criteria in the following tables in MRP-227-A: (a) Table 4-2 for "primary" RVI components, (b) Table 4-5 for "expansion" RVI components, and (c) Table 4-8 for "existing program" RVI components. Otherwise, the staff asked the applicant to justify why the AMP will implement the inspection criteria in Tables 4-3, 4-6, and 4-9 of the MRP-227-A report, as stated in the "detection of aging effects" program element discussion in the basis document for this AMP.

The applicant responded to RAI B.1.33-1, Part 1, in a letter dated October 13, 2015. In its response, the applicant clarified that the Reactor Vessel Internals program will implement the inspection criteria in the following tables of MRP-227-A: (a) Table 4-2 for "primary" RVI components, (b) Table 4-5 for "expansion" RVI components, and (c) Table 4-8 for "existing program" RVI components. The staff finds this to be acceptable because the applicant has verified that it will implement the inspection criteria for CE-designed RVI components in the MRP-227-A report. RAI B.1.33-1, Part 1, is resolved.

The staff noted a similar type of issue with the applicant's referencing of a table in MRP-227-A that is used to evaluate the results of programmatic inspections. Specifically, in the "acceptance criteria" program element of GALL Report AMP XI.M16A, the staff recommends that the applicants of CE-designed reactors implement the acceptance criteria in Table 5-2 of MRP-227-A to evaluate and disposition the inspection results of its RVI components. This applies to the RVI components in the WF3 plant design. However, during the staff's audit of this AMP, the staff found that the applicant's RVI program referenced use of the acceptance criteria in Table 5-1 of the MRP-227-A report, which applies to the evaluation of inspection results for inspections performed on RVI components designed by the Babcock & Wilcox Company (B&W).

By letter dated September 15, 2016, the staff issued RAI B.1.33-1, Part 2, requesting that the applicant provide clarification on the specific evaluation table in Chapter 5 of MRP-227-A that will be used to evaluate the results of RVI component inspections performed at WF3. Specifically, the staff asked the applicant to clarify whether LRA AMP B.1.33, "Reactor Vessel Internals," will implement the acceptance criteria in Table 5-2 of the MRP-227-A report. If not, the staff asked the applicant to justify why the AMP will implement the acceptance criteria in Table 5-1 of the report, as stated in the "acceptance criteria" program element discussion in the basis document for this AMP.

The applicant responded to RAI B.1.33-1, Part 2, in a letter dated October 13, 2015. In its response, the applicant clarified that the Reactor Vessels Internal program will implement the aging effect evaluation criteria in Table 5-2 of MRP-227-A. The staff finds this to be acceptable because the applicant has verified that it will implement the appropriate aging effect evaluation criteria for CE-designed RVI components in MRP-227-A. RAI B.1.33-1, Part 2, is resolved.

Enhancement. LRA Section B.1.33 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the Reactor Vessel Internals program procedures will be revised to include the inspections identified in NRC inspection plan submittal W3F1-2013-0070, dated December 16, 2013, including those inspection plan criteria for inspecting the core stabilizing bolts as an addition to the ASME Section XI Inservice Inspection program. The staff noted that the placement of this enhancement will ensure that the procedures for implementing this AMP will capture the RVI components in the inspection plan submitted to the staff in accordance with A/LAI No. 8, subitem 2, as issued in the staff's safety evaluation (SE) of the MRP-227-A report, dated December 16, 2011. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMP XI.M16A and finds it acceptable because when implemented it will ensure that implementation of the AMP will be done in accordance with: (1) the program elements in GALL Report AMP XI.M16A, and (2) the RVI inspection plan for the components, as approved in the SE dated October 6, 2016 (ADAMS Accession No. ML15267A797). Adjustments of the inspection bases for the RVI components are evaluated as part the staff's assessment of A/LAI for this AMP, which follows in the next section of this evaluation.

Review of Applicant/Licensee Action Items (A/LAIs)

In the staff's SE for the MRP-227-A report, the staff issued the following A/LAIs relative to the bases for implementing the methodology in the report:

- _A/LAI No. 1, "Applicability of FMECA [failure modes, effects, and criticality analyses] and Functionality Analysis Assumptions"_: In this A/LAI, the staff asked the applicant to refer to the assumptions regarding plant design and operating history made in the FMECA and functionality analyses for reactors of their NSSS design (i.e., Westinghouse, CE, or B&W) which support MRP-227-A and describe the process used for determining plant-specific differences in the design of their RVI components or plant operating conditions, which result in different component inspection.
- _A/LAI No. 2, "PWR Vessel Internal Components Within the Scope of License Renewal"_: For an applicant owning a CE-designed facility, the staff asked the applicant to review the information in Tables 4-4 and 4-5 of MRP-191 and to identify whether these tables contain all of the RVI components that are within the scope of LR for their facilities in accordance with 10 CFR 54.4. If the tables do not identify all the RVI components that are within the scope of LR for its facility, the staff asked the applicant to identify the missing component(s) and propose any necessary modifications to the program defined in MRP-227, as modified by this SE, when submitting its plant-specific AMP. The staff stated that the AMP shall provide assurance that the effects of aging on the missing component(s) will be adequately managed during the period of extended operation.
- _A/LAI No. 3, "Evaluation of the Adequacy of Plant-Specific Existing Programs"_: For an applicant owning a CE-designed facility, the staff asked the applicant to perform a plant-specific analysis of its existing programs for their thermal shield positioning pins and in-core instrumentation thimble tubes, and either justify the acceptability of the applicant's existing programs for these components, or identify any changes to the

programs for the components that should be implemented to manage the aging of these components during the period of extended operation.

- *A/LAI No. 4, "B&W Core Support Structure Upper Flange Stress Relief"*: This A/LAI applies to the design and basis for managing cracking in the upper flange welds in the core support structures of B&W-designed light water reactor facilities. This A/LAI does not apply to WF3 because it is a CE-designed light water reactor facility.
- *A/LAI No. 5, "Application of Physical Measurements as Part of I&E Guidelines for B&W, CE, and Westinghouse RVI Components"*: For an applicant owning a CE-designed light-water reactor with a core shroud containing a gap area, the staff asked the applicant to identify the plant-specific acceptance criteria that will be applied when performing the physical measurements for detecting distortion that may be occurring in the gap area between the top and bottom segments of the core shrouds. The staff asked the applicant to include its proposed acceptance criteria and an explanation of how the proposed acceptance criteria are consistent with the plant's licensing basis and the need to maintain the functionality of the component during the period of extended operation. This A/LAI is applicable to the design of the core shroud at WF3 because the core shroud is designed with a gap region.
- *A/LAI No. 6, "Evaluation of Inaccessible B&W Components"*: This A/LAI applies to the basis for managing and evaluating aging in inaccessible "expansion" category RVI components of B&W-designed light water reactor facilities. This A/LAI does not apply to WF3 because it is a CE-designed light water reactor facility.
- *ALAI No. 7, "Plant-Specific Evaluation of CASS Materials"*: For an applicant owning a CE-designed light water reactor facility, the staff asked the applicant to perform plant-specific assessments of its lower support columns to demonstrate that the components will maintain their functionality during the period of extended operation or for any additional RVI components that may be fabricated from CASS, martensitic stainless steel, or precipitation hardened stainless steel materials. The staff stated that the assessments should consider the possible loss of fracture toughness in materials used to fabricate the components due to thermal and irradiation embrittlement. In addition, the assessments may also need to consider limitations on accessibility for inspection and the resolution/sensitivity of the inspection techniques. The staff clarified that requests may not apply to components previously evaluated as not requiring aging management during development of MRP-227. That is, the staff clarified that the request would apply to those RVI components that are fabricated from susceptible materials for which an individual applicant has determined aging management is required (e.g., as part of its review performed in accordance with A/LAI No. 2). The staff stated that plant-specific assessment or analysis shall be consistent with the plant's licensing basis.
- *ALAI No. 8, "Submittal of Information for Staff Review and Approval"*: In this A/LAI, the staff reminded applicants of the need to submit the following information for staff approval in their LRAs: (a) AMP for their RVI components; (b) Inspection plan for their RVI components; (c) FSAR supplement summary description for their RVI AMP, in accordance with 10 CFR 54.21(d); (d) any new TS or TS changes that may need to be proposed to manage aging in the RVI components, as required by 10 CFR 54.22; and (e) any TLAAs that may apply to the evaluation of the RVI components at their facilities, in accordance with 10 CFR 54.21(c)(1).

The applicant addressed resolution of these A/LAIs in LRA Appendix C. The applicant stated that its responses to A/LAIs Nos. 1, 3, 4, 6, and 7 were included in the applicant's RVI inspection plan that was submitted for staff approval on December 16, 2013 (ADAMS Accession No. ML13352A041), and approved by the staff in an SE dated October 6, 2015 (ADAMS Accession No. ML15267A797). Of these A/LAIs, the staff verified that the applicant's bases for resolving A/LAIs Nos. 3, 4, 6, and 7 remain valid for operations through the end of the period of extended operation.

Specifically, for A/LAI No. 3 on aging management of CE-designed thermal positioning pins and incore instrumentation (ICI) thimble tubes, the staff confirmed: (a) the applicant had adequately demonstrated confirmation that the design of WF3 does not include thermal shield positioning pins, and (b) the applicant is addressing changes to the aging management basis for the ICI thimble tubes by resolving the request in A/LAI No. 2. For the requests in A/LAIs Nos. 4 and 6, the staff confirmed that the A/LAIs do not apply to the LRA because the A/LAIs only apply to RVI components in B&W-designed light water reactors and not to CE-designed RVI components. For the requests in A/LAI No. 7 for cast austenitic stainless steel internals, the staff confirmed that the assessment of thermal aging and neutron irradiation embrittlement in RVI components made from CF8 CASS materials is adequately bounded by the susceptibility assessment for these types of components in TR No. PWROG-15032, which was approved in an SE dated September 6, 2016 (ADAMS Accession No. ML16250A001). The staff also verified that the RVI design at WF3 does not include any RVI components made from martensitic stainless steel or precipitation hardened stainless steel materials. Thus, the staff confirmed that the applicant's basis for resolving A/LAIs Nos. 3, 4, 6, and 7 will remain valid for operations through conclusion of the period of extended operation. A/LAIs Nos. 3, 4, 6, and 7 are resolved with respect to the LRA contents and the staff's assessment of the Reactor Vessel Internals program.

However, the staff determined that the basis for resolving A/LAI No. 1 would need to be reevaluated to support operations of WF3 through the conclusion of the period of extended operation. Specifically, the staff noted that the closure of A/LAI No. 1 in the staff's SE of October 6, 2015, was only applicable to operations through the current operating term for the facility because it was done only in relation to the staff's approval of the extended power uprate (EPU) for WF3 in 2005, and was not evaluated in relation to proposed operations to the end of the period of extended operation. The staff resolves this issue in the assessment of the applicant's basis for addressing the request in A/LAI No. 8, subitem 5, which follows later in this evaluation and in the staff's evaluation in SER Section 4.7.4, "Reactor Vessel Internals Evaluations (Other Than Fatigue)."

In the applicant's response to A/LAI No. 2, the applicant identified that the following components were not explicitly evaluated in the generic aging assessment for CE-designed internals in MRP-191: (a) flow bypass inserts, (b) flow restrictor plugs, (c) core stabilizing shims, (d) core stabilizing dowel pins, (e) ICI couplings, and (f) core stabilizing bolts. Of these components, the applicant stated that the flow bypass inserts are part of the shroud assemblies in the control element assembly (CEA). The staff verified that the flow bypass inserts would be appropriately screened out as "No Additional Measures" components because, under the protocols of MRP-227-A, the applicant will be inspecting the instrumentation tubes CEA assemblies as the leading "primary" components for these assemblies.

For the other five components listed in the previous paragraph, the applicant stated that an expert panel evaluated the components in accordance with the screening methodology in MRP-191. The applicant determined that the flow restrictor plugs, core stabilizing shims and

dowel pins, and ICI coupling would not require any additional inspections under the MRP-191 screening methodology. However, based on operating experience, the expert panel also determined that the core stabilizing bolts would require inspections for relevant aging effects. The applicant stated that the core stabilizing bolts will be inspected as additional "Existing Program" components in accordance with implementation of the applicant's ASME Section XI Inservice Inspection program. The staff finds this to be acceptable because: (1) the applicant has applied the MRP-191 screening process to evaluate these components, and (2) the applicant has appropriately identified which components will be subject to additional inspections during the period of extended operation. In this case, the staff finds that use of the Inservice Inspection AMP is an appropriately defined AMP for managing aging in the core stabilizing bolts because they have been added as ASME Code Section XI Examination Category B-N-3 components in the CLB. A/LAI No. 2 is resolved with respect to the disposition of the flow bypass inserts, flow restrictor plugs, core stabilizing shims, core stabilizing dowel pins, ICI coupling, and core stabilizing bolts.

In response to A/LAI No. 2, the applicant also identified that the following components (as summarized in the table) were evaluated in MRP-191, but were fabricated from materials different from those assumed for the components in the MRP-191 methodology:

Component	**Material Assumed in MRP-191**	**Actual Material of Fabrication at WF3**
CEA shroud extension shaft guide cylinder	304 stainless steel (SS)	304L SS
CEA assembly instrument tube guide block	304 SS	UNS S21800 SS
CEA shroud bolt locking bars	286 SS	304 SS
Core shroud assembly: guide lug insert bolt dowel pin	286 SS	304 SS
ICI guide tubes	316 SS	304 SS

The applicant concludes that the change in the austenitic stainless steel materials would not impact the MRP-191 screening results for these components and, therefore, that the inspection categories and bases in MRP-227-A would remain valid for the components during the period of extended operation. The staff noted that these material differences only amounted to a minor change in the type of austenitic stainless steel material that was selected to fabricate the components. The staff determined that the differences in the materials would not impact the EPRI MRP's screening processes or MRP-191 screening results for these components because: (1) the changes only involved minor differences in the type of austenitic stainless steel material selected for fabrication of the components, and (2) the austenitic stainless steel materials selected in the WF3 design would have reasonable ductility and corrosion resistance properties during plant operations.

In relation to the applicant's response to A/LAI No. 2, the applicant identified one plant-specific change that would impact the inspection criteria in MRP-227-A. In MRP-191, EPRI identifies that CE-designed thimble tubes are made from zircaloy materials that may be susceptible to a "loss of material due to wear" aging effect. In documentation reviewed during the staff's audit of this AMP, the staff noted that the applicant identified that it had replaced its ICI thimble tubes with zircaloy tubes that were plated with high chromium content stainless steel materials that render the tubes more resistant to "wear." Therefore, based on its review, the staff finds that the applicant does not need to identify loss of material due to wear as an applicable AERM for the ICI thimble tubes because the new tube material will either prevent wear from occurring in the tubes or will effectively minimize (i.e., mitigate) any wear in the tubes if it does occur. The staff's issue on this matter is resolved. However, the applicant also identified that the ICI thimble tubes

could be susceptible to a different aging effect not identified in MRP-227-A. Specifically, the applicant identified that the ICI thimble tubes would be susceptible to changes in dimension (i.e., distortion) induced by a void swelling or irradiation-growth mechanism. To account for this, the applicant identified that the RVI program would be adjusted to include physical measurements of the ICI thimble tubes to monitor for this aging effect. The staff noted that this type of plant-specific management basis is consistent with other MRP-defined or PWROG-defined physical measurement bases for managing changes in dimension or distortion in PWR RVI components.

In addition, the staff observed that the applicant did not specifically define the type of physical measurements that will be performed on the ICI thimble tubes during the period of extended operation. Therefore, by letter dated September 15, 2016, the staff issued RAI B.1.33-2 requesting that the applicant define: (1) the type of physical measurements that will be used to monitor for changes in dimension (due to grain growth, void swelling, or distortion) of the ICI thimble tubes, and (2) the inspection schedule/frequency that is/will be applied to the physical measurements of these components. The staff also asked the applicant to provide and justify the acceptance criteria that will be used to assess the results of the measurements.

The applicant responded to RAI B.1.33-2 in a letter dated October 13, 2016. The applicant stated that 53 of the 56 ICI thimble tubes were replaced in 2009, and at that time, baseline physical measurements were taken on 9 of the ICI thimbles tubes. The applicant stated that the measurements used a measuring cable with a ball on its end that is inserted into the thimble tube until the ball bottoms out at the end of the thimble. The applicant stated that the top flange of the ICI cluster is used as a reference point and that the distance from the ball to the top flange of the ICI cluster indicates the length of the thimble.

The applicant also explained that the ICI thimble tube growth is a slow process and that the new ICI thimble tubes are 7.5 inches shorter than the original ICI thimble tubes. Based on the length of the new ICI thimble tubes and the expected thimble growth rate, the applicant explained that additional thimble length measurements will not be necessary until 2024. The applicant also stated that any need for further inspections and the schedule for those inspections will be determined by the results of the measurements taken in 2024. The applicant stated that the acceptance criterion for the ICI thimble tube measurements will be that the length of the ICI thimble tubes is such that it does not reach the fuel assembly lower end fitting during reactor operation.

The staff noted any void swelling (i.e., irradiation-induced growth) that may induce potential distortion in these components is a slow aging phenomenon. Therefore, the staff concludes that the applicant's response to RAI B.1.33-2 provides a sufficient explanation for: (1) how the RVI program will be implemented to perform physical measurements of the ICI thimble tubes, (2) how and when the physical measurements will be performed, and (3) the acceptance criteria that will be applied to the results of the physical measurements. Since the projections for inspecting the components are based on a technical growth rate and the replaced thimble tubes are shorter than those used in the original plant design, the staff finds this to be a sufficient basis for adjusting the inspection protocols of the ICI thimble tubes. RAI B.1.33-2 is resolved.

Based on this assessment, the staff concludes that the applicant has provided a sufficient basis for evaluating the RVI design under A/LAI No. 2 and identifying the changes to the programmatic inspection protocols for RVI components at WF3 when compared to those defined for CE-designed internals in MRP-227-A. This includes the applicant's proposed basis to: (1) inspect the core stabilizing bolts in accordance with the applicant's ASME Section XI

Inservice Inspection program, and (2) perform physical measurements of the ICI thimble tubes in 2024. A/LAI No. 2 is resolved.

In its response to A/LAI No. 5, the applicant identified the acceptance criteria for the gap between the interfacing plates of the core shroud upper and lower subassemblies. However, the applicant did not provide the source that was used to determine the acceptance criteria. During the staff's audit of the Reactor Vessel Internals program, the staff confirmed that the source used to establish the acceptance criteria for the gap area in the core shroud is appropriately addressed in Technical Report No. WCAP-17096-NP-A, Revision 2, which was approved in an SE dated May 3, 2016 (ADAMS Accession No. ML16061A243). Therefore, the staff finds that the applicant has appropriately addressed the request in A/LAI No. 5 because: (a) the applicant has identified the acceptance criteria that will be used to assess the physical measurements that will be performed on the core shroud gap region, and (b) these acceptance criteria have been accepted in the staff's SE for WCAP-17096-NP-A, Revision 2. A/LAI No. 5 is resolved.

The staff noted that the applicant also resolved the requests in A/LAI No. 8, Parts 1-3, because the applicant had conformed to the following requests:

- included LRA AMP B.1.33, "Reactor Vessels Internals," as part of the LRA for WF3, which resolves the request in A/LAI No. 8, Part 1
- submitted the RVI inspection plan for WF3 to the staff for approval and received approval of the inspection plan, which resolves the request in A/LAI No. 8, Part 2
- included the FSAR supplement summary description for the Reactor Vessel Internals program in LRA Section A.1.33, which resolves the request in A/LAI No. 8, Part 3

In response to A/LAI No. 8, Part 4, the applicant stated that there are not any new TS or TS changes that need to be made to manage the effects of aging in the RVI components of the facility. The staff reviewed the TS for the facility and verified that the LRA would not need to include any new TS or TS amendments to manage the effects of aging in the RVI components for WF3. A/LAI No. 8, Part 4 is resolved.

In response to A/LAI No. 8, Part 5, the applicant identified two different TLAAs that apply to the RVI components at the plant: (a) the metal fatigue analyses (i.e., CUF analyses) for the RVI components, as discussed, and evaluated in LRA Section 4.3.1.2; and (b) plant-specific, non-fatigue TLAA for the RVI components, as discussed, and evaluated in LRA Section 4.7.4.

The staff observed that, in relation to A/LAI No. 8, Part 5, the applicant provides its metal fatigue TLAA for the RVI components in LRA Section 4.3.1.2. The applicant states that this TLAA is acceptable in accordance with the criterion in 10 CFR 54.21(c)(1)(iii). In addition, the applicant stated that AMP B.1.11, "Fatigue Monitoring," will be used for managing the impacts of cumulative fatigue damage or cracking by fatigue on the intended function of the RVI component during the period of extended operation. The staff evaluates this TLAA in SER Section 4.3.1.2.

For the RVI configuration in the WF3 design, the criteria in MRP-227-A Table 4-2 require the applicant to perform EVT-1 visual inspections of its lower flange weld in the core support barrel assembly and core support plate in the lower support structure if the applicant cannot demonstrate adequacy of fatigue life of the components using a TLAA. The staff verified that the applicant's inspection plan for the RVI components will include performance of EVT-1

examinations of the lower flange weld in the core support barrel assembly and core support plate consistent with the inspection criteria specified in MRP-227-A. However, the staff noted that LRA Section 4.3.1.2 did not specify which of the other RVI components were analyzed with a CUF analysis or fatigue waiver analysis in the CLB. During a teleconference with the applicant on November 3, 2016, Entergy stated that it did a bounding CUF analysis for the reactor internals and did not do a specific CUF analysis for the individual RVI components. The applicant stated that it will use the Fatigue Monitoring program to manage these components and that the transients for Class 1 components will also apply to the reactor internals components. The staff finds this acceptable because the applicant's single bounding fatigue analysis applies to all the RVI components.

In relation to A/LAI No. 8, Part 5, the applicant provides its plant-specific, non-metal fatigue TLAA for the RVI components in LRA Section 4.7.4. The applicant identifies that the aging evaluations of irradiation-assisted SCC and loss of fracture toughness due to thermal aging and neutron irradiation embrittlement in its 2003 EPU license amendment request are analyses that conform to the definition of a TLAA in 10 CFR 54.3(a). The applicant stated that the implementation of LRA AMP B.1.33, "Reactor Vessel Internals," will ensure that the TLAA is acceptable in accordance with 10 CFR 54.21(c)(1)(iii). The staff evaluates this TLAA in SER Section 4.7.4.

The staff confirmed that the RVI metal fatigue and fluence-related TLAAs are the only TLAAs that are applicable to the RVI components and need to be evaluated for RVI components in accordance with the requirement in 10 CFR 54.21(c)(1). The staff did not identify any other analyses for RVI components that conform to the definition of a TLAA in 10 CFR 54.3(a), which otherwise might need to be identified and evaluated in accordance with the requirements in 10 CFR 54.21(c)(1). Therefore, A/LAI No. 8, Part 5, is resolved with respect to the applicant's identification and evaluation of TLAAs that apply to the RVI components.

The staff noted that the referenced license amendment request for the EPU was submitted on November 3, 2003, and approved in an NRC-issued SE dated April 15, 2005 (ADAMS Accession No. ML051030068). SE Section 2.1.4 identifies that the projected neutron fluences for RVI components in the vicinity of the reactor core will range from 3.0–5.0 x 10^{22} n/cm^2 (E > 0.1 MeV) through 40 years of licensed operations. However, in MRP-191, EPRI estimates that RVI components in the core shroud would generally have neutron fluences ranging from 1.0–5.0 × 10^{22} n/cm^2 through 60 years of licensed operations. The staff observed that the RVI components were already projected to be close to or at the bounds of ERPI's thresholds for inducing IASCC and neutron irradiation embrittlement at the end of the current licensing period (i.e., at 40 years of licensed operations). Thus, the staff determined that it would need additional demonstration that the neutron fluence values for the RVI components would not exceed the fluence estimates for the components in Table 4-7 of MRP-191, when assessed through 60 years of licensed operations. Otherwise, the staff determined that it would need further assessment of the inspection bases for core shroud assembly components if the 60-year projected fluences for these components will exceed those specified for the components in the MRP-191 report.

By letter dated November 7, 2016, the staff issued RAI 4.7.4-1 to the applicant. In this RAI, the staff asked the applicant to justify (with a technical explanation) why the projected neutron fluences for RVI core shroud components through 60 years of license operations are considered to be bounded by the fluence estimates for these components in Table 4-7 of the MRP-191 report. Otherwise, the staff asked the applicant to clarify what the impact would be on the FMECA assessment for these components and the inspection plan for the RVI components if it

is determined that the 60-year neutron fluence value for any RVI core shroud component will exceed the neutron fluence estimate for the component in Table 4-7 of MRP-191.

In its response dated February 6, 2017, the applicant stated that the fluence values for RVI components in EPRI Report MRP-191 are estimates. It also stated that the estimates are not bounding values above which the MRP-191 evaluations would be invalid. The applicant referenced MRP-2013-025, “MRP-227-A Applicability Template Guideline,” which establishes a range of conditions for which the MRP-227-A inspection and evaluation guidelines are applicable. The criteria for plant-specific applicability for CE designs are:

(1) active fuel to fuel alignment plate (FAP) distance > 12.4 inches
(2) average core power density < 110 Watts/cm^3
(3) heat generation rate figure of merit, F ≤ 68 Watts/cm^3

The applicant also stated that the guidelines in MRP-2013-025 were established to ensure that plant-specific fluence levels remained within acceptable values to ensure continuing applicability of MRP-277-A. In addition, the applicant stated that there is no impact on the inspection plan for RVI components if the 60-year neutron fluence value for any RVI core shroud component exceeds the neutron fluence estimate for the components in Table 4-7 of the MRP-191 report.

The staff reviewed MRP-2013-025, which states that MRP-227-A I&E Guidelines should remain applicable as long as the average core power and peripheral heat generation limits imposed remain bounding. It also states that the utility response with regard to the applicability for the uprated condition should consist of appropriate text to identify the uprated plant condition and should include responses to Questions 1 and 2.

> Question 1: Does the plant have any non-welded or bolted austenitic stainless steel (SS) components with 20 percent cold work or greater, and, if so, do the affected components have operating stresses greater than 30 ksi? (If both conditions are true, additional components may need to be screened in for stress corrosion cracking, SCC).
>
> Question 2: Does the plant have atypical fuel design or fuel management that could render the assumptions of MRP-227-A, regarding core loading/core design, non-representative for that plant?

The applicant provided responses to these questions as well as its plant-specific values for the average core power density, heat generation rate figure of merit, and fuel alignment plate distance in PWROG-15039-P, “Waterford Unit 3 Summary Report for the Fuel Design/Fuel Management Assessments to Demonstrate MRP-227-A Applicability.” The staff noted that the values were determined based on the EPU, which was approved in the SE dated April 15, 2005 (ADAMS Accession No. ML051030068). The staff determined that the applicant’s plant-specific values comply with the values in MRP-2013-025. In addition, the staff reviewed WCAP-17780-P, “Reactor Internals Aging Management MRP-227-A Applicability for CE and Westinghouse Pressurized Water Reactor Designs,” which also confirms the applicability requirements of MRP-2013-025. Therefore, the staff finds the applicant’s response acceptable because the applicant has provided sufficient demonstration that the design of the RVI components are bounded by the design assumptions in MRP-227-A and the fluence assumptions in MRP-2013-025. RAI 4.7.4-1 is resolved.

Operating Experience. LRA Section B.1.33 summarizes operating experience related to the RVI program. Relevant operating experience for the RVI components in CE-designed light water reactors is adequately discussed in Appendix A of the MRP-227-A report. In relation to the design of the RVI components at WF3, the applicant demonstrated its responsiveness to relevant operating experience by replacing the ICI thimble tubes with tubes made from a more wear-resistant material. The staff observed that the program also sets inspection protocols for those RVI components that have experienced incidents of aging.

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 was either outside of the bounds of the generic operating experience assessment for CE-designed plants in MRP-227-A or not appropriately assessed and dispositioned by the applicant on a plant-specific basis. Thus, the staff finds that the applicant has addressed the operating experience that is applicable to the design of the RVI components at WF3.

FSAR Supplement. LRA Section A.1.33 provides the FSAR supplement for the Reactor Vessel internals program. The staff reviewed this FSAR 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 enhanced this program to implement the existing Reactor Vessel Internals program during the period of extended operation. Specifically, the applicant stated that the Reactor Vessel Internals program will be enhanced as follows:

- revise Reactor Vessel Internals Program procedures to include the inspections identified in the inspection plan in NRC submittal W3F1-2013-0070, dated December 16, 2013, including the inspection of the core stabilizing bolts as an addition to the WF3 ASME Section XI In-Service Inspection Program

The staff verified that the scope of the applicant's enhancement includes the applicant's plant-specific basis for inspecting the ICI thimble tubes for potential distortion or changes in dimension of the components. The staff also verified that the applicant has included this enhancement in the FSAR supplement summary description for the AMP and in Commitment No. 27 of LRA Appendix A, Section A.4, "License Renewal Commitment List," in which the applicant commits to implement the program prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later. The staff verified that the implementation dates coincide with the dates for implementing augmented inspections of "primary" category RVI components for CE-designed plants in the MRP-227-A report. Therefore, the staff finds the timing for implementing the program to be acceptable because it is consistent with the dates for implementing the inspections of the RVI components in MRP-227-A.

Therefore, based on this review, the staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Reactor Vessel Internals program, the staff determines that the program elements for which the applicant claimed consistency with the GALL Report are consistent with the program elements in GALL Report AMP XI.M16A,

"PWR Vessel Internals." Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Service Water Integrity

Summary of Technical Information in the Application. LRA Section B.1.36 describes the existing Service Water Integrity (SWI) program as consistent, with enhancements, with GALL Report AMP XI.M20, "Open-Cycle Cooling Water," as modified by LR-ISG-2012-02. The LRA states that the AMP manages loss of material and reduction of heat transfer as described in the WF3 response to GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The program addresses carbon steel, stainless steel, copper alloy, and gray cast iron components in raw water environments and manages aging through surveillances, control techniques, tests, and walkdowns.

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.

For the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements, the staff determined a need for additional information, which resulted in the issuance of RAIs, as discussed below.

For the "parameters monitored or inspected" program element, the staff noted that the applicant only manages loss of material for the wet cooling tower distribution nozzles in LRA Table 3.3.2-3 and does not consider flow blockage due to fouling for this raw water system. The staff noted that the current program includes inspections of the distribution nozzles for clogging; however, the applicant was not crediting these inspections for license renewal and considered them unnecessary for aging management. By letter dated October 12, 2016, the staff issued RAI B.1.36-1 requesting that the applicant provide the bases for not needing to manage flow blockage of the wet cooling tower distribution nozzles.

In its response dated November 10, 2016, the applicant stated that the water chemistry in the basin is maintained per site procedures and is less corrosive and contains fewer particulates than typical service water systems. Additionally, the nozzles are designed to be clog resistant and the last five biennial inspections for clogging did not identify any fouling or blockage issues with these nozzles. The applicant concluded that flow blockage was not an AERM for the wet cooling tower flow distribution nozzles.

In its review of the applicant's response, the staff noted that biological fouling of the basins (based on LER 382/1994-004) had degraded the heat transfer capability of a CCW heat exchanger, indicating past problems with basin water chemistry control. In addition, loss of coating integrity for the galvanized distribution piping in the wet cooling towers is not being managed, so future inspection results cannot be based on past inspection findings. By letter dated January 26, 2017, the staff issued RAI B.1.36-1a requesting that the applicant: (1) demonstrate that the distribution nozzles did not include any flow control function (i.e., did

not need to provide control of flow rate or establish a pattern of spray) and (2) show that there is no potential for flow blockage due to fouling from accelerated corrosion of upstream piping due to wetting and drying of the distribution piping, because galvanized coating degradation was not being managed.

In its response dated February 23, 2017, the applicant revised LRA Table 2.3.3-3, Table 3.3.1, and Table 3.3.2-3 to add "flow control" as an intended function of the distribution nozzles. The applicant also revised LRA Sections A.1.30 and B.1.30 to inspect the wet cooling tower nozzles for flow blockage using the Periodic Surveillance and Preventive Maintenance program. The staff finds the applicant's response acceptable because the appropriate intended functions of the distribution nozzles are now being considered and appropriate aging management activities will be performed to manage the associated aging effects for these intended functions. The staff's concerns described in RAI B.1.36-1 and B.1.36-1a are resolved.

For the "scope of program" program element, the staff noted that all portions of the nonsafety-related wet cooling tower chemical addition and filtration system were excluded from the scope of license renewal. The staff noted that the siphon breaker holes in the suction piping for this system are cited in the design basis document for the auxiliary component cooling water (ACCW) system as eliminating the potential for inadvertently removing water from the basins due to a pressurized leak. By letter dated October 12, 2016, the staff issued RAI B.1.36-2 requesting that the applicant justify the exclusion of the wet cooling tower chemical addition and filtration system from the scope of license renewal.

In its response dated November 10, 2016, the applicant stated that the entire system was appropriately excluded because level indicators and alarms would alert the plant staff to a low level in the wet cooling tower basin caused by flow blockage of the siphon breaker holes, and this would allow for corrective actions to restore the basin level. In its review of the applicant's response, the staff noted that blockage of the siphon breaker holes could not be identified during some design basis events because basin levels will drop below the alarm levels and basin level indicators will show decreasing values due to evaporation. In addition, it was unclear to the staff why portions of the chemical addition and filtration system (other than the siphon breaker holes) that are either within or above the basins can be excluded from the scope of license renewal. By letter dated January 26, 2017, the staff issued RAI B.1.36-2a requesting that the applicant show that the failure of components in the nonsafety-related system cannot prevent satisfactory accomplishment of an ACCW system intended function.

In its response dated February 23, 2017, the applicant stated, for the portions of the chemical addition and filtration system that are either within or above the wet cooling tower basin, that aging effects for nonsafety-related piping component supports are managed by the Structures Monitoring program. The applicant also stated that, consistent with guidance in NEI 95-10, failure of nonsafety-related piping sections is not considered credible as long as the aging effects for the nonsafety-related pipe supports are managed. The applicant revised LRA Table 2.3.3-3, Table 3.3.1 item 3.3.1-134, and Table 3.3.2-3 by adding "flow control" as an intended function of the nonsafety-related piping associated with the siphon breaker holes and by adding the nonsafety-related flex hoses as a component type. The applicant also revised LRA Sections A.1.30 and B.1.30 to add inspections for flow blockage of the siphon breaker holes using the Periodic Surveillance and Preventive Maintenance program. The staff finds the applicant's response acceptable because the appropriate intended functions are now being considered and appropriate aging management activities will be performed to manage the associated aging effects for these intended functions. The staff's concerns described in RAIs B.1.36-2 and B.1.36-2a are resolved.

For the “parameters monitored or inspected” and “detection of aging effects” program elements, the staff noted that the enhancement described in the LRA (regarding program procedure changes to monitor the basins for biological fouling), appeared to be identical to the activities included in the applicant’s January 29, 1990, response to GL 89-13, Action 1. By letter dated October 12, 2016, the staff issued RAI B.1.36-3 asking the applicant to reconcile the need for enhancing the program for an activity that appeared to already be included in its CLB.

In its response dated November 10, 2016, the applicant stated that further reviews of site procedures concluded that the enhancement to monitor the basins for biological fouling was unnecessary. The applicant stated that the visual inspections described in GL 89-13 are performed every 4 years and the water sampling for different indications of biological fouling are monitored on a quarterly and monthly basis. The applicant revised LRA Sections A.1.36 and B.1.36 by deleting this enhancement to the program. The staff finds the applicant’s response acceptable because current implementing procedures include visual inspections and water sampling requirements, which eliminated the need to enhance the program. In its review of the applicant’s response, the staff noted that the initial response to GL 89-13 states that these activities are performed on a weekly basis, whereas the current program conducts these activities far less frequently. The staff provided the information to the regional inspection staff for evaluation of the bases for this apparent change to a GL 89-13 commitment. The staff’s concern described in RAI B.1.36-3 is resolved.

For the “detection of aging effects” program element, the staff noted that the applicant’s January 29, 1990, response to GL 89-13 Action III (which addresses various forms of degradation, including erosion) indicates that the components in the ACCW system will be added to the site’s erosion/corrosion program (the prior designation of the Flow-Accelerated Corrosion program). However, although several CRs show that some components in the ACCW system are susceptible to erosion, the ACCW system is currently excluded from the Flow-Accelerated Corrosion program. By letter dated October 12, 2016, the staff issued RAI B.1.36-4 asking how the current SWI program accomplishes the activities for GL 89-13, Action III and whether a planned enhancement to the Flow-Accelerated Corrosion program to address erosion will be credited by accomplishing portions of GL 89-13, Action III.

In its response dated December 12, 2016, the applicant stated that its commitments to GL 89-13 are implemented through preventive maintenance activities that perform routine inspections of the components near the valves where cavitation erosion occurs in the ACCW system. The applicant revised LRA Sections A.1.36 and B.1.36 to explicitly state that the program manages loss of material due to cavitation erosion through periodic visual inspections and with volumetric examinations as necessary.

In its review of the applicant’s response, the staff noted that LRA Table 3.3.2-3 includes AMR item 3.3.1-126 for carbon steel valve bodies that are being managed for loss of material due to erosion by the Flow-Accelerated Corrosion program. The staff also noted that the current program procedure, EN-DC-184, already includes provisions for volumetric examinations (ultrasonic or radiographic testing) to determine wall thickness in locations susceptible to localized erosion. The discussion in the associated AMR report (WF3-ME-14-00009, Section 3.1.1) notes that the erosion mechanism only applies to select valves in the ACCW system. However, based on the above changes to LRA Sections A.1.36 and B.1.36, the ACCW valves subjected to cavitation erosion are being managed by the SWI program, which includes volumetric examinations. Because it was unclear to the staff which valves were within the scope of the Flow-Accelerated Corrosion program, by letter dated February 14, 2017, the staff

issued RAI B.1.36-4a requesting that the applicant clarify which components are included through item 3.3.1-126 in LRA Table 3.3.2-3.

In its response dated March 16, 2017, the applicant stated that there are no components in the ACCW system for which the Flow-Accelerated Corrosion program manages the effects of aging. Based on this, the applicant revised LRA Section 3.3.2.1.3, Table 3.3.1 item 3.3.1-126, and Table 3.3.2-3 to indicate that the Flow-Accelerated Corrosion program does not manage loss of material due to erosion for the carbon steel valves exposed to raw water. The staff finds the applicant's response acceptable because the cited corrections clarified that the aging effects for ACCW components susceptible to erosion will be managed by the SWI program. The staff's concerns described in RAIs B.1.36-4 and B.1.36-4a are resolved.

For the "preventive actions" program element, the staff noted that the current program procedure, EN-DC-184, Step 5.0[6](a)(2), requires flushing and flow testing to ensure flow blockages do not form in infrequently used flow paths. However, LRA Section B.1.36 includes an enhancement to revise SWI procedures to flush infrequently flowed and stagnant lines to prevent flow blockage, with a commitment to implement the enhancement by 2024. The staff noted that although GL 89-13, Action I specified flushing and flow testing as a control technique to resolve service water system problems, the applicant's December 29, 1990, response to GL 89-13, Action I, did not commit to flushing the ACCW system. The 1990 response discussed the use of corrosion inhibitors and the use of demineralized water for the make-up water source as the basis for concluding that the existing Chemical Control program was effective. However, during its review of operating experience, the staff noted that although the program includes corrosion inhibitors and uses demineralized water for makeup, sufficient fouling existed in the system to plug certain drain lines in the system. By letter dated October 12, 2016, the staff issued RAI B.1.36-5 requesting that the applicant clarify whether any changes were made to the SWI program after identifying the plugged drain lines and to clarify what portions of the SWI program procedures need to be revised as part of the enhancement, because the current program already requires flushing through EN-DC-184, Step 5.0[6](a)(2).

In its response dated December 12, 2016, the applicant stated that no changes were made to the SWI program with respect to flushing-required flow paths as a result of finding a plugged drain line, because the drain line is not a critical flow path. The applicant also clarified that the provisions of EN-DC-184, Step 5.0[6](a)(2) did not apply to the ACCW system because (as explained in the 1990 response to GL 89-13) the ACCW system is started at least once per week and the system was operated from May through November. The applicant then stated that the provisions of EN-DC-184, Step 5.0[6](a)(2) did apply to the piping from the ACCW system to the emergency feedwater system, which the enhancement would make part of the SWI program.

In its evaluation of the applicant's RAI response, the need for the future program enhancement caused the staff to question the applicant's GL 89-13 response, regarding the lack of periodic flushing and flow testing for the portion of the ACCW system piping that supplies water to the emergency feedwater system. Unless periodic flushing or flow testing is performed, bulk chemical treatment in the ACCW basin would not be applicable to the water in these stagnant lines. The staff notes that the CLB includes the ACCW supply to the emergency feedwater system based on the statement in FSAR Section 10.4.9, "Emergency Feedwater System," regarding makeup from one of the ACCW basins. The staff also noted that, based on LER 382/1994-004, past ACCW basin water chemistry controls were insufficient to prevent fouling in excess of design basis values in the CCW heat exchanger. By letter dated February 14, 2017, the staff issued RAI B.1.36-5a requesting that the applicant show that the

current SWI program does not need to include periodic flushing or flow testing of the ACCW piping that supplies water to the emergency feedwater system.

In its response dated March 16, 2017, the applicant stated that quarterly flushing of the flow path from the ACCW to the emergency feedwater system had been in place since 1997; however, the applicant initiated a CR to identify other flushing requirements for infrequently used loops that should be included in the current SWI program. The staff independently verified that the applicant initiated a CR (CR-WF3-2017-01417), which satisfies the requirement in 10 CFR 54.30(a) for the applicant to take measures under its current license to resolve CLB issues. The staff finds the applicant's response acceptable because the entry into the corrective action program ensures that flushing activities for the current program will be appropriately addressed, eliminating the need for the staff's review as part of license renewal. The staff's concerns described in RAIs B.1.36-5 and B.1.36-5a are resolved.

During its evaluation of components in LRA Table 3.3.2-3, the staff noted that the corresponding AMP evaluation report for the ACCW system (WF3-ME-14-00009) included a one-time inspection to manage loss of material for carbon steel piping that was not reflected in the LRA table. In addition, the AMP evaluation report included an item to manage loss of material for the carbon steel tank in the system through the Water Chemistry Control – Closed Treated Water Systems that also was not reflected in the LRA table. By letter dated October 12, 2016, the staff issued RAI B.1.36-6 requesting that the applicant reconcile the discrepancy between the AMP evaluation report WF3-ME-14-00009 and LRA Table 3.3.2-3.

In its response dated November 10, 2016, the applicant stated that the aging management review summary (AMRS) report (WF3-EP-14-00010) "reconciles and summarizes the results from system aging management review reports, such as WF3-ME-14-00009, and from aging management review topical reports, such as the WF3 license renewal topical report on coating integrity." The applicant concluded that LRA Table 3.3.2-3 was consistent with the tables in the AMRS and, therefore, there were no discrepancies with any design basis documents.

In its review of the applicant's response, the staff noted that the AMRS report (WF3-EP-14-00010) does not reflect the statements in the RAI response "the AMRS report <u>reconciles</u> [emphasis added] and summarizes the results" of the system AMR reports and the topical AMR reports. Although additional items from the topical AMR reports may be added to the system tables in the AMRS, an explanation for the lines that have been deleted from the system AMR tables is not provided in the basis documentation. By letter dated January 27, 2017, the staff issued RAI B.1.36-6a requesting that the applicant either correct the discrepancies in the relevant basis documentation discussed in the original request or update the basis documentation to explain why items have been deleted from the system AMR report, WF3-ME-14-00009.

In its response dated February 23, 2017, the applicant stated that the AMRS report modified the piping and tank components that were shown as carbon steel in WF3-ME-14-00009 to indicate that they are carbon steel with internal coating. The applicant also stated that the statement in the RAI, taken from the AMRS report, was lacking context because the report discussion only addressed examples of exceptions where AMR report results are changed. In order to add clarity, the applicant stated it will revise the AMRS report to add an additional example for changes in piping component material from "carbon steel" to "carbon steel with internal coating," noting that the remaining columns are revised as appropriate based on the different material. The staff finds the applicant's response acceptable because the AMRS report will be revised to explain the bases for changes from the system AMR report, which will meet the requirements of

10 CFR 54.37 for retaining information necessary to document compliance with 10 CFR Part 54 in an auditable form. The staff's concerns documented in RAIs B.1.36-6 and B.1.36-6a are resolved.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.1.36 includes an enhancement to the "preventive actions" program element to revised program procedures to flush infrequently flowed sections and stagnant lines to ensure there is no blockage and to inspect selected low flow, stagnant, or system low points. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M20. As noted above in the discussions for RAIs B.1.36-5 and B.1.36-5a, portions of this enhancement are associated with activities that should have been included in the current SWI program, based on the prescribed activities in EN-DC-184. The applicant's initiation of a CR addressed the issues regarding the current SWI program. Based on this, the staff finds this enhancement acceptable because when it is implemented appropriate preventive actions, as provided in GALL Report AMP XI.M20, will ensure that there are no blockages.

Enhancement 2. LRA Section B.1.36 includes an enhancement to the "parameters monitored or inspected" and "detection of aging effects" program elements to revise program procedures to monitor the ACCW basins for biological fouling. The need for this enhancement was discussed above in RAI B.1.36-3 because the current commitments to GL 89-13 appeared to include the activities described in the enhancement. As noted above, the applicant deleted this enhancement because the program already includes the applicable activities to monitor the ACCW basins for biological fouling.

Based on its audit and review of the applicant's responses to RAIs B.1.36-1, -1a, -2, -2a, -3, -4, -4a, -5, -5a, -6, and -6a, 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. In addition, the staff reviewed the enhancement associated with the "preventive actions" program elements and finds that when implemented it will make the AMP adequate to manage the applicable aging effects.

Operating Experience. LRA Section B.1.36 summarizes operating experience related to the SWI program. The LRA describes an ultimate heat sink assessment in 2008, which identified weaknesses in component testing intervals for Waterford's GL 89-13 program. The weaknesses were addressed by including actions to track completion of the CCW heat exchanger testing. In addition, the LRA describes an assessment in 2010, which identified a weakness in how periodic actions are tracked. Corrective actions to address the condition included a review of environmental changes that could impact the intake structure and the ultimate heat sink.

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 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.

FSAR Supplement. LRA Section A.1.36, as modified by RAI responses dated November 10, 2016, and December 12, 2016, provides the FSAR supplement for the SWI program. The staff reviewed this FSAR 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 June 8, 2024, or the end of the last refueling outage before December 18, 2024, whichever is later (commitment no. 29 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's SWI program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent with AMP XI.M20. Also, the staff reviewed the enhancement and confirmed that its implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 Structures Monitoring

Summary of Technical Information in the Application. LRA Section B.1.38 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 satisfy the requirements of 10 CFR 50.65 and is based on guidance in RG 1.160, Revision 2, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" and NUMARC 93-01, Revision 2, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The AMP manages the effects of aging on structures, structural components, and bolting within the scope of license renewal as delineated in 10 CFR 54.4, and implicitly monitors the condition of coatings on SSCs.

The LRA states that concrete structures are inspected for indications of deterioration and distress, including cracking, loss of strength, loss of bond, loss of material, and increase in porosity and permeability; and steel components are inspected for loss of material due to corrosion. Other components such as supports, elastomers, and bolting will be inspected for loss of material, reduction in anchor capacity, loss of sealing, hardening, and loss of preload. Environments include air-outdoor; air-indoor, uncontrolled; exposed to fluid; and groundwater and soil. The LRA also states that the AMP ensures that inspections are performed at least once every 5 ,years to ensure no loss of intended functions. The AMP includes provisions for increased inspection frequency if the extent of degradation is such that the structures or components may not meet their design bases before the next scheduled inspection. The AMP

also includes provisions for periodic sampling and analysis of groundwater for pH, chlorides and sulfates on a 5-year frequency to ensure that groundwater remains non-aggressive.

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 "preventive actions," "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 "parameters monitored or inspected," and "detection of aging effects" program elements in GALL Report AMP XI.S6 recommend that high-strength structural bolts (actual measured yield strength greater than or equal to 150 ksi) greater than 1 inch (25 mm) in diameter be monitored for SCC, and that visual inspections be supplemented with volumetric or surface examinations to detect cracking. However, during its audit, the staff found that the applicant's Structures Monitoring program excluded managing the aging effects of SCC in high-strength structural bolts and stated, in part, that "since molybdenum disulfide thread lubricants are not used at WF3, for structural bolting applications, SCC of high strength structural bolting is not an aging effect requiring management at WF3." While the GALL Report specifically states that the use of MoS_2 as a lubricant is a potential contributor to SCC in high-strength bolts, the GALL Report does not limit MoS_2 thread lubricant as the only contributor to the aging mechanism for SCC. In addition, in its review during the audit, the staff found that the plant's structural specifications and drawings do not preclude the use of high-strength structural bolts with diameter greater than 1 inch when specified or noted as such in the drawing details; therefore, the staff was unclear whether high-strength structural bolts are used at WF3 for structural applications. By letter dated October 12, 2016, the staff issued RAI B.1.38-1 requesting that the applicant (1) clarify whether there are high-strength structural bolts in sizes greater than 1 inch diameter used in structural applications, and (2) if high-strength structural bolts are used in structural applications, to state whether and how the recommendations for managing SCC of high-strength bolts described for these program elements in the GALL Report will be implemented for the Structures Monitoring program. The staff requested that, if high-strength bolts would not be managed for SCC, the applicant provide adequate technical justification for the exception to the GALL Report AMP recommendation.

In its response to RAI B.1.38-1, dated January 9, 2017, the applicant stated that it identified the following high-strength structural bolting with actual measured yield strength greater than or equal to 150 ksi in sizes greater than 1-inch diameter as within the scope of the Structures Monitoring program: ASTM A-540 threaded bolts/studs from the reactor coolant pump (RCP), safety injections tanks (SITs), and RCS supports. The applicant also stated that these bolts/studs are monitored in the Structures Monitoring program using visual inspections, and that the GALL Report AMP XI.S6 recommendations for managing cracking of high-strength bolts due to SCC are not necessary because the environment conditions for SCC are not present. The applicant stated that these connections are in a non-corrosive, low-temperature and low-stress environment where SCC in these bolts is not expected, and thus cracking due to SCC is not an AERM for these bolts.

Following a clarification teleconference on March 16, 2017, the applicant supplemented its response to RAI B.1.38-1, in a letter dated April 11, 2017. The applicant stated that the Structures Monitoring program will be enhanced to include a periodic visual examination to confirm the absence of a corrosive environment for A-540 high-strength bolts/studs at the SIT

supports, and the RCS supports and stops. The applicant also stated that one inspection will be performed prior to the period of extended operation and at least once every 5 years thereafter. The applicant also included, in part, the following enhancements to the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements:

- The acceptance criteria for the periodic visual examinations will be the absence of evidence of moisture, residue, foreign substances, or corrosion.
- Conditions that do not meet the acceptance criteria, indicating a potential corrosive environment that supports SCC, will be entered into the corrective action program for evaluation.
- Should adverse conditions be identified during the examinations, engineering will determine if the bolting has been exposed to a corrosive environment with the potential to cause SCC. Bolts determined to have been exposed to a corrosive environment with the potential to cause SCC will be identified as within a population where SCC is a concern. A sample equal to 20 percent (rounded up to the nearest whole number) of the population, with a maximum sample size of 25 bolts will be subject to volumetric examination. The selection of the samples will consider susceptibility to stress corrosion cracking (e.g., actual measured yield strength) and ALARA [as low as reasonably achievable] considerations.

As part of the evaluation, the applicant stated that engineering will evaluate the identified adverse conditions to determine if the bolting has been exposed to a corrosive environment with the potential to cause SCC, and a supplemental visual examination or analysis of residue will be conducted if necessary to determine if there is potential for SCC. The applicant further stated that monitoring the environmental indicators and performing visual examinations under the Structures Monitoring program at a 5-year interval, as described in the supplemented response and the proposed enhancements, will be effective in managing the aging effect of SCC. The applicant revised LRA Table 2.4-1, LRA Table 3.5.1, items 3.5.1-68 and 3.5.1-69, LRA Table 3.5.2-1, and LRA Appendix A and Appendix B, accordingly.

The staff finds the applicant’s response acceptable because: (1) the applicant identified the high-strength structural bolts in sizes greater than 1-inch diameter used at WF3 in the scope of license renewal; (2) the applicant clarified that the identified high-strength structural bolts are subject to a noncorrosive, low-temperature, and low-stress environment not susceptible to the SCC aging effect; and (3) the enhancements to the Structures Monitoring program to monitor and evaluate, as necessary, the surface condition of the bolting and adjacent structures will provide adequate assurance that the environment remains non-corrosive and without the potential to cause SCC during the period of extended operation. The staff also finds the applicant’s response acceptable because the program enhancements will ensure that volumetric examination will be performed, consistent with the GALL Report recommendation, for those adverse conditions identified as susceptible to SCC after the evaluation. The staff’s concern described in RAI B.1.38-1 is resolved.

The “preventive actions” program element in GALL Report AMP XI.S6 recommends that if structural bolting consists of ASTM A325, ASTM F1852, and/or ASTM A490 bolts, the preventive actions for storage, lubricants, and SCC potential discussed in RCSC Section 2 need to be used. However, during its audit, the staff found that the applicant’s Structures Monitoring program excluded the use of preventive actions for lubricants, and SCC potential, by stating that a review of Section 2 of the RCSC publication concluded that the publication only addressed storage and does not address the preventive actions for lubricants and SCC potential for these

bolts. By letter dated September 15 2016, the staff issued RAI B.1.6-2 requesting that the applicant clarify how the described enhancement in the “preventive actions” program element in the LRA AMP is adequate to establish consistency with GALL Report AMP XI.S6, or to justify an exception to the GALL Report AMP. The staff noted that this RAI is a common issue for the “preventive actions” program element across LRA AMPs B.1.6, “Containment Inservice Inspection – IWE,” B.1.16, “Inservice Inspection – IWF,” and B.1.38 “Structures Monitoring.” The staff’s evaluation of this issue is addressed under SER Section 3.0.3.2.4.

The staff also reviewed the portions of the “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects” 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.1.38 includes an enhancement to the “scope of program” program element. In this enhancement, the applicant stated that plant procedures will be revised to include the following in-scope structures:

- battery house 230 kV switchyard
- control house 230 kV switchyard
- fire pump house
- fire water storage tank foundations
- fuel oil storage tank foundation
- manholes, handholes, and duct banks
- plant stack
- transformer and switchyard support structures and foundations

The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will address additional 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 to monitor and assess the impact of age-related degradation on in-scope structures, and to provide assurance that the age-related degradation can be detected and quantified before there is a loss of intended function(s).

Enhancement 2. LRA Section B.1.38 includes an enhancement to the “scope of program” program element. In this enhancement, the applicant stated that plant procedures will be revised to include a list of structural components and commodities within the scope of license renewal. The staff notes that LRA Table 2.4.4 provides a list of bulk commodities components subject to an AMR. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will include a list of all structural components and commodities within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4.

Enhancement 3. LRA Section B.1.38 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 plant procedures will be revised to include periodic sampling and chemical analysis of groundwater. The applicant also stated that sampling and chemical analysis will be performed at least once every 5 years and will monitor pH, chlorides, and sulfates. 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 at least once every 5 years. This enhancement makes the applicant's "scope of program," "parameters monitored or inspected," and "detection of aging effects" program elements consistent with the recommendations provided in GALL Report AMP XI.S6 for evaluation of groundwater impact on below-grade concrete.

Enhancement 4. LRA Section B.1.38 includes an enhancement to the "preventive actions" program element. In this enhancement, the applicant stated that plant procedures will be revised to include preventive actions for storage of ASTM A325, ASTM F1852, and ASTM A490 bolting stated in Section 2 of the RCSC publication. In addition, in its response to RAI B.1.6-2 (dated September 15, 2016), the applicant stated that the WF3 AMP in LRA Section B.1.6 uses (existing) implementing procedures that incorporate the guidance contained in NUREG–1339 and in EPRI Report NP-5769, NP-5067, and TR-104213 to ensure proper specification of bolting material, lubricants and sealants, and installation torque or installation appropriate for the intended purpose. The applicant also stated that preventive actions for lubricants and SCC potential are already included in WF3 plant procedures that provide guidance for the selection of bolting material, the selection of installation torque or tension, and use of lubricants and sealants, and no additional enhancement is necessary for these preventive actions. The staff reviewed this enhancement, and the applicant's response to RAI B.1.6-2, against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will include preventive actions for storage, lubricants, and SCC potential from industry guidelines, as recommended by the GALL Report, to ensure bolting integrity.

Enhancement 5. LRA Section B.1.38 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that plant procedures will be revised to base inspections of concrete structures on quantitative requirements from industry codes, standards, and guidelines (e.g., American Society of Civil Engineers 11, American Concrete Institute (ACI) 349.3R) and the consideration of industry and plant-specific operating experience. 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 an acceptable basis commensurate with industry codes, standards, guidelines, and operating experience for the selection of parameters to be monitored or inspected for concrete and steel structural elements, as recommended by the GALL Report.

Enhancement 6. LRA Section B.1.38 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that plant procedures will be revised to include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation as parameters to be monitored or inspected for concrete SCs. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will ensure that aging degradation leading to loss of intended function in concrete SC will be detected and the extent of degradation determined, consistent with the recommendations provided in the "parameters monitored or inspected" program element of GALL Report AMP XI.S6.

Enhancement 7. LRA Section B.1.38 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that plant procedures will be revised to include anchor bolts (nuts and bolts) as components to be monitored for loss of material, and for loose or missing nuts and bolts. The staff reviewed this enhancement

against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will ensure that aging degradation leading to loss of intended function in anchor bolts (nuts and bolts) will be detected and the extent of degradation determined, consistent with the recommendations provided in the “parameters monitored or inspected” program element of GALL Report AMP XI.S6.

Enhancement 8. LRA Section B.1.38 includes an enhancement to the “parameters monitored or inspected” program element. In this enhancement, the applicant stated that plant procedures will be revised to include elastomeric vibration isolators and structural sealants as components to be monitored for cracking, loss of material, loss of sealing, and changes in material properties (e.g., hardening.) The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will ensure that aging degradation leading to loss of intended function of elastomeric vibration isolators and structural sealants will be detected and the extent of degradation determined, consistent with the recommendations provided in the “parameters monitored or inspected” program element of GALL Report AMP XI.S6.

Enhancement 9. LRA Section B.1.38 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that plant procedures will be revised to ensure that visual inspection of elastomeric material is supplemented by feel or touch to detect hardening if the intended function of the elastomeric material is suspect. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will ensure that aging degradation of elastomeric material will be detected before there is loss of intended function, consistent with the recommendations provided in the “detection of aging effects” program element of GALL Report AMP XI.S6.

Enhancement 10. LRA Section B.1.38 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that plant procedures will be revised to ensure that structures are inspected at least once every 5 years with provision for more frequent inspections of SCs categorized as (a)(1) in accordance with 10 CFR 50.65. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6 and finds it acceptable because when it is implemented it will ensure that inspection frequencies are dependent on the safety significance and condition of the structures consistent with industry guidelines, and with the recommendations provided in the “detection of aging effects” program element of GALL Report AMP XI.S6.

Enhancement 11. LRA Section B.1.38 includes an enhancement to the “detection of aging effects” program element. In this enhancement, the applicant stated that plant procedures will be revised to ensure that submerged structures will be inspected at least once every 5 years. The staff reviewed this enhancement against the corresponding program elements in GALL Report AMPs XI.S6 and XI.S7, and finds it acceptable because when it is implemented it will ensure that submerged structures are inspected at least once every 5 years consistent with industry guidelines to ensure that degradation is detected before a loss of an intended function, and consistent with the recommendations provided in the “detection of aging effects” program element in GALL Report AMPs XI.S6 and XI.S7.

Enhancement 12. LRA Section B.1.38 includes an enhancement to the “parameters monitored or inspected,” and “detection of aging effects” program elements. In this enhancement, the applicant stated that:

- Plant procedures will be revised to inspect the safety injection tanks (SITs) and reactor coolant system (RCS) supports with ASTM A-540 high-strength bolting greater than 1-inch nominal diameter prior to the period of extended operation and at least once every 5 years thereafter. Periodic visual inspections are intended to detect whether a corrosive environment that supports stress corrosion cracking (SCC) potential exists or has existed since the previous inspection
- Acceptance criteria for the inspections will be the absence of evidence of moisture, residue, foreign substances, or corrosion
- Conditions that do not meet the acceptance criteria and thus indicate a potential corrosive environment that supports SCC will be entered into the corrective action program for evaluation

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 (1) confirm, before entering the period of extended operation, that high-strength structural bolting greater than 1-inch diameter has not been exposed to a corrosive environment that is conductive to SCC; (2) ensure, during the period of extended operation, that the environment remains not conducive to SCC using periodic visual examination of the high-strength bolts; and (3) ensure that any high-strength bolts identified to have a potential corrosive environment that supports SCC will be entered into the corrective action program for further evaluation.

Enhancement 13. LRA Section B.1.38 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that plant procedures will be revised to include qualitative and quantitative acceptance criteria for A-540 bolts if moisture is present at or near a bolt or stud, and if there is evidence that moisture had been present at or near a bolt or stud. The applicant listed some of the factors to be considered by engineering and stated, in part, that should an adverse condition be identified during the examinations, bolts determined to have been exposed to a corrosive environment with the potential to cause SCC will be identified as within a population where SCC is a concern. The applicant further stated that a sample equal to 20 percent (rounded up to the nearest whole number) of the population, with a maximum sample size of 25 bolts will be subject to volumetric examination. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.S6, and finds it acceptable because when it is implemented it will ensure that high-strength structural bolts in sizes greater than 1 inch in diameter with an environment conductive to SCC be monitored at least once every 5 years using volumetric examination consistent with the recommendations provided in GALL Report AMP XI.S6.

Based on its audit, and review of the applicant's responses to RAIs B.1.38-1 and B.1.6-2, 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.1.38 summarizes operating experience related to the Structures Monitoring program. A summary description of relevant operating experience that demonstrates the inspections similar to those conducted under the program have been able to identify aging effects that are entered and evaluated in the corrective action program to determine appropriate corrective actions, is provided below.

In 2010, plant personnel identified deficiencies in the sealant used at several cracks and joints in the Turbine Building roof. The cracked and missing caulk allowed rainwater to enter inside the building. This condition was entered into the corrective action program and actions were taken to correct the condition. None of the equipment that the rainwater came into contact with was safety-related equipment or equipment required for ensuring accident prevention, mitigation, or safe plant shutdown.

In 2012, plant personnel identified four grouted locations at the east wall of the "B" DCT with potential concrete degradation. The condition was entered into the corrective action program. During its onsite audit, the staff reviewed the report, which stated that the grout had a grid-like surface cracking pattern similar to those observed for concrete degradation from alkali-silica reaction (ASR), and recommended to perform further evaluation of the observed conditions to determine the cause of the cracking. Actions taken by the applicant included a walkdown inspection of the Nuclear Plant Island Structure (NPIS), and no evidence of ASR was found for the reinforced concrete; the indications were only found in grouted applications. The report concluded that no evidence of ASR was found in the structural concrete, and the as-found condition was determined acceptable.

In 2012, the SG replacement project engineering team identified cracks on the exterior and interior surfaces of the new Shield Building concrete wall. The maximum width of cracks measured was 0.016 inches, and most of them were 0.007 inches or less. This condition was entered into the corrective action program and an engineering evaluation concluded that the cracks are acceptable, and do not affect the structural qualification of the Shield Building or the Shield Building's ability to perform its design basis functions. The identified cracks were found to be within the acceptable width criteria previously evaluated for existing cracks in the Shield Building wall.

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 and resulted in the issuance of an RAI, as discussed below.

During its audit, the staff reviewed CRs that documented corrective actions to address several plant-specific operating experiences associated with corrosion of structural steel, supports, and components, and that addressed the history of several CRs associated with the keyword "corrosion." The staff also observed outdoor structures with ongoing corrosion during the audit walkdowns. Based on the staff review of this plant-specific operating experience and staff-observed conditions during the audit walkdowns of outdoor structures, it was not clear to the staff (1) how the Structures Monitoring program captures the operating experience (i.e., the existing corrosion concerns from recent inspections) and whether the conditions and operating experience at the plant is bounded by the conditions and operating experience for which the GALL Report program was evaluated in AMP XI.S6; and (2) whether and how the Structures Monitoring program specified inspection frequency of 5 years remains adequate, considering the recent operating experience, to ensure no loss of intended functions during the period of extended operation for those structures with ongoing exterior corrosion concerns. By letter dated October 12, 2016, the staff issued RAI B.1.38-2 requesting that the applicant clarify the adequacy of the Structures Monitoring program specified inspection frequency of 5 years,

considering the most recently identified operating experience, to ensure no loss of intended function during the period of extended operation.

In its response to RAI B.1.38-2, dated December 12 2016, the applicant stated that recent WF3 operating experience associated with corrosion of structures and structural components was documented in numerous CRs, and actions taken as a result of corrosion concerns included the preparation of a site procedure for monitoring coatings and corrosion to help management identify corrosion, classify the extent of corrosion, and prioritize the corrective actions necessary to remediate adverse issues. The applicant also stated that the more frequent coating and corrosion inspections were established to ensure that degraded condition due to corrosion are identified during routine plant operation and are entered into the corrective action program. The applicant further stated that although more frequent inspections are performed under the inspection procedure for monitoring coating and corrosion, the 5-year inspection frequency for the Structures Monitoring program has been shown adequate to ensure no loss of intended function, and inspections have not identified loss of function of structures inspected under the program. The applicant also stated that its Structures Monitoring program states that where existing site programs are in effect (e.g., Coating and Corrosion program) credit may be taken for the examination performed by these station programs, where the review of existing program activities under the WF3 Structures Monitoring program provides further assurance that loss of material due to corrosion is adequately managed to ensure there is no loss of intended function of structures during the period of extended operation.

The staff finds the applicant's response acceptable because: (1) recent operating experience associated with corrosion of structures and structural components has been reviewed under the WF3 Structures Monitoring program and has been entered and evaluated in the corrective action program to determine appropriate corrective actions, and (2) the applicant's operating experience for structural inspections demonstrates that the inspection frequency of 5 years remains adequate to identify degradation for structures prior to a loss of intended function. The staff's concern described in RAI B.1.38-2 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.1.38-2, 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.S6 was evaluated.

FSAR Supplement. LRA Section A.1.38 provides the FSAR supplement for the Structures Monitoring program. The staff reviewed this FSAR 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 prior to the period of extended operation (commitment no. 30 as listed in Appendix A). The staff finds that the information in the FSAR supplement, as amended by letter dated April 11, 2017, is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Structures Monitoring 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 prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.21 Water Chemistry Control – Closed Treated Water Systems

Summary of Technical Information in the Application. LRA Section B.1.40 describes the existing Water Chemistry Control – 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 LRA states that the AMP manages loss of material, cracking, and reduction of heat transfer through monitoring and control of water chemistry. Based on the LRA, the program includes the use of corrosion inhibitors, chemical testing, and visual inspections of internal surface conditions with guidance derived from EPRI 1007820, "Closed Cooling Water Chemistry Guideline," industry and in-house operating experience, and vendor recommendations.

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 and LR-ISG-2012-02. 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 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.1.40 includes an enhancement to the "scope of program" program element. In this enhancement, the applicant stated that the program procedures would be revised to include the jacket water system for the high-pressure diesel fire water pump. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M21A and finds it acceptable because when it is implemented the program will include the closed treated water portion of the high-pressure diesel fire water pump.

Enhancement 2. LRA Section B.1.40 includes an enhancement to the "parameters monitored or inspected" program element. In this enhancement, the applicant stated that the program procedures would be revised to specify water chemistry parameters and the corresponding acceptable ranges in accordance with EPRI 1007820, industry guidance, and vendor recommendations. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M21A and finds it acceptable because the program will include the specific parameters being controlled to achieve prevention or mitigation of aging effects.

Enhancement 3. LRA Section B.1.40 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the program procedures would be revised to inspect accessible components whenever a closed treated water boundary is opened and to conduct inspections that are capable of detecting corrosion, fouling, or cracking for a representative sample of components at least every 10 years. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M21A. The staff notes that this is consistent with the guidance in the AMP and finds the enhancement acceptable because the opportunistic and periodic inspections will verify the effectiveness of the water chemistry controls.

Enhancement 4. LRA Section B.1.40 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the program procedures would be revised to define a representative sample of a population (having the same material, environment, and aging effect combination), as 20 percent, up to a maximum of 25 components, with inspections conducted on those most likely to exhibit the aging effects. The staff reviewed this enhancement against the corresponding program element in GALL Report AMP XI.M21A, with additional guidance from LR-ISG-2012-02. The staff notes that the representative sample size and inspection focus are consistent with those recommendations and finds the enhancement acceptable because the program will identify likely degradation caused by chemistry control issues.

Enhancement 5. LRA Section B.1.40 includes an enhancement to the "detection of aging effects" program element. In this enhancement, the applicant stated that the program procedures would be revised to perform treated water sampling and analysis in accordance with industry standards, but not greater than on a quarterly basis without analytical justification. The staff reviewed the enhancement against the corresponding program element in GALL Report AMP XI.M21A. The staff notes that the sampling and analysis frequency will be consistent with the recommendations in the GALL Report and finds the enhancement acceptable because periodic activities will identify chemistry control issues in a timely manner.

Enhancement 6. LRA Section B.1.40 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the program procedures would be revised to specify the acceptable range of values, for the parameters monitored, based on EPRI 1007820, industry guidance, or vendor recommendations. The staff reviewed the enhancement against the corresponding program element in GALL Report AMP XI.M21A and finds it acceptable because the acceptable range of values provided by industry guidelines will minimize the effects of aging.

Enhancement 7. LRA Section B.1.40 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that the program procedures would be revised to provide acceptance criteria, such as minimum wall thickness, to ensure that system components meet design requirements. The staff reviewed the enhancement against the corresponding program element in GALL Report AMP XI.M21A and finds it acceptable because the intended functions of components will be assured by meeting design requirements.

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.M21A. 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.

Operating Experience. LRA Section B.1.40 summarizes operating experience related to the Water Chemistry Control – Closed Treated Water Systems program. The LRA describes an instance in August 2013, where quarterly samples of the CCW system identified a higher than historical operating range for chloride concentrations. Although the levels remained within specified limits, the applicant used "feed and bleed" operations and more frequent monitoring activities until chloride levels returned to stable historical values. The LRA also describes an occurrence in October 2007, where the stator cooler alkalizer skid was unable to maintain conductivity within specified limits. The condition was addressed by draining and flushing the alkalizer storage tank, and this action was confirmed to address the condition.

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 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.

FSAR Supplement. LRA Section A.1.40 provides the FSAR supplement for the Water Chemistry Control – Closed Treated Water Systems program. The staff reviewed this FSAR 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 enhance this program as described in LRA Section B.1.40 prior to June 18, 2024 (commitment no. 32 as listed in Appendix A). The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its audit and review of the applicant's Water Chemistry Control – Closed Treated Water Systems program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the program enhancements and confirmed that their implementation prior to 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 FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Periodic Surveillance and Preventive Maintenance

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 Periodic Surveillance and Preventive Maintenance

Summary of Technical Information in the Application. LRA Section B.1.30, as modified by letters dated November 10, 2016, December 12, 2016, January 9, 2017, February 1, 2017, February 23, 2017, and March 16, 2017, describes the existing Periodic Surveillance and Preventive Maintenance (PSPM) program as a plant-specific program with enhancements that will be used to manage the aging of components that do not fall within the scope of other AMPs. The LRA states that the AMP addresses metallic, cementitious, and elastomeric components

exposed to various environments and manages loss of material, reduction of heat transfer, cracking, and change in material properties (for elastomeric and cementitious components). The LRA also states that the AMP proposes to manage these aging effects through periodic visual and nondestructive volumetric inspections, including physical manipulation (for elastomeric components).

Staff Evaluation. During its audit, 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 follows. The staff's reviews of the "corrective actions," "confirmation process," and "administrative controls" program elements are documented in SER Section 3.0.4.

Scope of Program. LRA Section B.1.30 states that the PSPM program includes those specific SCs identified in the AMRs that are tabulated in the LRA program description.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs, the aging of which the program manages.

The staff did not find the applicant's "scope of program" program element to be adequate because it was unclear if tanks in the blowdown system are included within the scope of the program. Although LRA Table 3.4.2-5-1 lists tanks, the program description table provided in LRA Section B.1.30 does not. By letter dated October 12, 2016, the staff issued RAI B.1.30-1 requesting that the applicant reconcile this apparent discrepancy. In its response dated November 10, 2016, the applicant revised the program description table provided in LRA Section B.1.30 to include tanks as a component type in the blowdown system.

The staff finds the applicant's response acceptable and the "scope of program" program element to be adequate because it resolved the apparent discrepancy by clarifying that tanks in the blowdown system are included within the scope of the program. Therefore, the applicant has provided information that clearly identifies the specific components covered by the program. The staff's concern described in RAI B.1.30-1 is resolved.

In its responses to RAIs associated with other AMPs (B.1.10-4a, B.1.28-2, B.1.36-1a, and B.1.36-2a), the applicant revised the program description in LRA Section B.1.30 to include additional inspections in the PSPM program that are credited for managing aging. Details related to these inspections are documented in the associated SER Sections 3.0.3.1.13, 3.0.3.2.6, and 3.0.3.2.20.

Based on its review of the application, review of the applicant's response to RAI B.1.30-1, and review of additional responses to RAIs cited above, the staff confirmed that the "scope of program" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.1.30 states that the program is a condition monitoring program and does not include preventive actions.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that if the program does not rely on preventive actions,

the information need not be provided. The staff noted that the PSPM program does not prevent the effects of aging, but instead provides a means for detecting the degradation prior to a loss of intended function.

The staff finds the applicant's "preventive actions" program element to be adequate because the applicant has provided information that clearly identifies the program as being a condition monitoring program only, with no preventive actions needing description.

Based on its review of the application, the staff confirmed that the "preventive actions" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.1.30 states that the program monitors and inspects parameters linked to the degradation of the particular structure or component intended function(s).

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the program element should identify the aging effects that the program manages and should provide a link to the parameters that will be monitored. SRP-LR Section A.1.2.3.3 also states that the parameters monitored should be capable of detecting the presence and extent of aging effects.

The staff did not find the applicant's "parameters monitored or inspected" program element to be adequate because it was unclear if physical manipulation would be used to augment visual inspection of the elastomeric portable smoke-ejector duct in the control room HVAC system. The "parameters monitored or inspected" program element states that polymeric components are inspected for hardening as evidenced by loss of suppleness, which implies, but does not explicitly state, physical manipulation. However, the program description table states that the inspection will consist of a visual inspection and the "detection of aging effects" program element states that established techniques, such as visual inspections are used, indicating that physical manipulation may not be used to augment visual inspections. By letter dated October 12, 2016, the staff issued RAI B.1.30-2 requesting that the applicant clarify whether physical manipulation will be used to augment visual inspection of the elastomeric portable smoke-ejector duct.

In its response dated November 10, 2016, the applicant revised the LRA Section B.1.30 program description table and the "detection of aging effects" program element to clarify that physical manipulation will be used to augment visual inspection of the elastomeric portable smoke-ejector duct. The staff finds the applicant's response to be acceptable and the "parameters monitored or inspected" program element to be adequate because visual inspections augmented by physical manipulation are capable of detecting elastomer degradation. The staff's concern described in RAI B.1.30-2 is resolved.

The staff noted that this program is used to manage loss of material of gray cast iron pump casings, which are subject to selective leaching and would thus require physical manipulation to detect loss of material due to this aging mechanism. However, the applicant is using the Selective Leaching program to manage loss of material due to selective leaching for gray cast iron. In addition, in its responses to RAIs associated with other AMPs (B.1.28-2 and B.1.36-1a), the applicant revised the "parameters monitored or inspected" portion of LRA Section B.1.30 to describe inspections of reinforced concrete piping and wet cooling tower spray nozzles.

Additional details related to these inspections are documented in the associated SER Sections 3.0.3.1.13 and 3.0.3.2.20.

Based on its review of the application, and review of the applicant's responses to RAIs B.1.30-2, B.1.28-2, and B.1.36-1a, the staff confirmed that the "parameters monitored or inspected" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.1.30 states that preventive maintenance activities and periodic surveillances provide for periodic component inspections to detect aging effects. The LRA also states that established techniques such as visual inspections are used, and each inspection occurs at least once every 5 years, except for the circulating water intake piping inspection, which is addressed below. The LRA further states that for each activity that refers to a representative sample, a representative sample is 20 percent of the population with a maximum of 25 components.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the program element should address how age-related degradation will be detected prior to a loss of component function and should describe all aspects of data collection activities (e.g., inspection technique, frequency, timing). The SRP-LR Section A.1.2.3.4 also states that inspection samples should be biased toward locations most susceptible to the specific aging effect of concern.

The staff did not find the applicant's "detection of aging effects" program element to be adequate because it was unclear (1) what inspection activities are included in monitoring the surface condition of the stainless steel expansion joints in the EDG system in order to verify the absence of cracking; (2) whether a visual inspection of the external surfaces of the stainless steel heat exchanger tubes exposed to lubricating oil, fuel oil, and treated water in the EDG system can be reasonably expected to detect loss of material due to wear; and (3) whether the aluminum heat exchanger fins and carbon steel heat exchanger tubes exposed to condensation in the component cooling and ACCW system will be managed for loss of material using the External Surfaces Monitoring program or the PSPM program. By letter dated October 12, 2016, the staff issued (1) RAI B.1.30-3 requesting that the applicant provide details about the monitoring activities in the PSPM program for the surface condition of the EDG stainless steel expansion joints to verify the absence of cracking; (2) RAI B.1.30-4 requesting that the applicant justify the adequacy of the visual inspection to detect loss of material due to wear for EDG heat exchanger tubes; and (3) RAI B.1.30-5 requesting that the applicant clarify whether loss of material for the aluminum heat exchanger fins and carbon steel heat exchanger tubes in the component cooling and ACCW system will be managed using the External Surfaces Monitoring program or the PSPM program.

In its responses dated December 12, 2016, the applicant stated (1) monitoring the surface condition of the stainless steel expansion joint consists of performing a visual inspection of the expansion joint external surface and expansion joint liner internal surface to verify the absence of cracking; (2) eddy current testing of a representative sample will be used in lieu of visual inspections to detect loss of material due to wear for the EDG heat exchanger tubes; and (3) the External Surfaces Monitoring program and not the PSPM program manages loss of material for the aluminum heat exchanger fins and carbon steel heat exchanger tubes in the component cooling and ACCW system. However, as amended by letter dated February 1, 2017, in response to RAI B.1.10-4a for the External Surfaces Monitoring program, the applicant stated that loss of material and cracking for the aluminum heat exchanger fins would be managed

using the PSPM program. The staff's evaluation of the adequacy of the PSPM program to manage loss of material and cracking for the aluminum heat exchanger fins is documented in SER Section 3.3.2.3.3. The applicant revised portions of LRA Sections A.1.30 and B.1.30 to reflect the associated changes to the PSPM program.

The staff finds the applicant's responses acceptable because: (1) performing visual inspections on all accessible surfaces of the stainless steel expansion joints exposed to diesel exhaust every 5 years to verify the absence of cracking is more conservative than GALL Report item VII.H2.AP-128, which recommends visual inspections every 10 years; (2) eddy current testing is capable of detecting loss of material due to wear for the EDG heat exchanger tubes; and (3) the applicant clarified that loss of material for the carbon steel heat exchanger tubes will be managed using the External Surfaces Monitoring program and loss of material and cracking for the aluminum heat exchanger fins will be managed using the PSPM program. The staff's concerns described in RAIs B.1.30-3, B.1.30-4, and B.1.30-5 are resolved.

In summary, the staff finds the "detection of aging effects" program element to be adequate because visual inspections are capable of detecting cracking, loss of material due to corrosion, and fouling of metallic components. In addition, as noted in RAI B.1.30-4 above, eddy current testing is capable of detecting loss of material due to wear for the EDG heat exchanger tubes. Further, visual inspections augmented by physical manipulation are capable of detecting cracking, loss of material due to wear, and change in material properties of elastomers. The staff also noted that the performance of these inspections by qualified personnel at least once every 5 years (except for the circulating water intake piping inspection, which is addressed below) on a representative sample of components, focusing on locations most prone to aging, is capable of detecting aging prior to loss of component function.

Based on its review of the application, and review of the applicant's responses to RAIs B.1.30-3, B.1.30-4, B.1.30-5, and B.1.10-4a, the staff confirmed that the "detection of aging effects" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

<u>*Monitoring and Trending*</u>. LRA Section B.1.30 states that preventive maintenance activities provide for monitoring and trending of aging degradation. The LRA also states that inspection intervals are established such that they provide for timely detection of component degradation. The LRA further states that inspection intervals take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described and 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 the program's preventive maintenance activities include inspection intervals that are informed by operating experience, such that aging degradation can be detected prior to loss of intended function.

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 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.1.30 states that the PSPM program acceptance criteria are defined in specific inspection procedures and the criterion is no indication of relevant degradation, and any identified degradation is evaluated.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that acceptance criteria should be qualitative or quantitative and should ensure that the SC intended functions are maintained consistent with all CLB design conditions.

The staff finds the applicant's "acceptance criteria" program element to be adequate because the use of no indication of relevant degradation ensures that any degree of aging beyond that normally observed in the subject components will be evaluated such that component intended functions will be maintained consistent with the CLB.

Based on its review of the application, the staff confirmed that the "acceptance criteria" program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

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.1.30 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 the program will be enhanced to revise program procedures as necessary to include all activities identified in the LRA Section B.1.30 program description table. The staff finds the enhancement acceptable because it will establish appropriate inspection activities to ensure that the LRA program is implemented.

Enhancement 2. LRA Section B.1.30 includes an enhancement to the "acceptance criteria" program element. In this enhancement, the applicant stated that program procedures will be revised to state that the acceptance criterion is no indication of relevant degradation and such indications will be evaluated. The staff's review of this enhancement is documented above in the review of the "acceptance criteria" program element.

In summary, 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.

Operating Experience. LRA Section B.1.30 summarizes operating experience related to the PSPM program. The LRA describes a QA audit in 2013, which found that both maintenance and engineering personnel used plant and industry operating experience to improve the evaluation of components and systems in the program. The LRA also describes a finding in a February 2015 NRC inspection report regarding the failure to develop a preventive maintenance schedule to inspect all portions of the DCTs and notes that the conditions identified in this report were corrected. The applicant stated that the operating experience provides objective evidence that the PSPM program will be effective in managing aging effects for components by identifying problems, initiating corrective action, and implementing program improvements.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects 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 found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

In its response to RAI B.1.28-2 for a different AMP, the applicant acknowledged that the One-Time Inspection program was not the most appropriate program to manage the effects of aging for concrete circulating water piping and instead credited the PSPM program. This was based on a previous inspection report, indicating that the concrete piping had experienced minor degradation and should be inspected again in the future.

In its response to RAI B.1.28-2 dated March 16, 2017, the applicant proposed to manage the effects of aging via visual inspections, conducted every 10 years under the PSPM program. The applicant noted that the 10-year frequency was appropriate because the operating pressure is normally low, the piping only serves a license renewal function in the event of a tornado that requires makeup to the ACCW wet cooling tower basins, the piping is normally inaccessible, and the condition of the piping during the last inspection was generally good. The initial inspection will be conducted prior to the period of extended operation.

The staff reviewed the applicant's response and noted that the corresponding GALL Report AMR items (VII.C1.AP-248 through AP-250) recommend periodic inspections for managing the effects of aging for this material/environment combination. The staff finds the proposed 10-year frequency acceptable because the prior inspection found the concrete in generally good condition and 10 years is a common, industry accepted frequency for reinforced concrete inspections. Therefore, the staff finds it acceptable to manage this component under the PSPM program because the component is receiving the recommended visual inspections on an acceptable frequency. The staff's concern described in RAI B.1.28-2 is resolved.

Based on its audit, review of the application, and the applicant's response to RAI B.1.28-2, the staff finds that the applicant has appropriately evaluated plant-specific and industry operating experience, that operating experience related to the applicant's program demonstrates that it can adequately manage the effects of aging on SSCs within the scope of the program, and that implementation of the program has resulted in the applicant taking corrective actions. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A.1.30, as amended by letters dated December 12, 2016, January 9, 2017, February 23, and March 16, 2017, provides the FSAR supplement for the PSPM program. The staff reviewed this FSAR supplement description of the program and noted that it is consistent with the recommended description in SRP-LR Table 3.0-1. The FSAR supplement contains a complete description of the in-scope components, their aging management activities, and the enhancements to the program. The staff also noted that the applicant committed to implement the enhancements prior to the period of extended operation. The staff finds that the information in the FSAR supplement is an adequate summary description of the program.

Conclusion. Based on its technical review of the applicant's PSPM program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that

the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in the Application

In LRA Appendix A, "Final Safety Analysis Report Supplement," Section A.1, "Aging Management Programs," and Appendix B, "Aging Management Programs and Activities," Section B.0.3, "Corrective Action, Confirmation Process 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, states, in part:

> The corrective action, confirmation process, and administrative controls of the WF3 (10 CFR Part 50, Appendix B) Quality Assurance program are applicable to all aging management programs and activities during the period of extended operation. WF3 quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The WF3 Quality Assurance program applies to safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety-related structures and components are accomplished in accordance with the established WF3 corrective action program and document control program and are applicable to all aging management programs and activities during the period of extended operation. The confirmation process is part of the corrective action program.

LRA Appendix B, Section B.0.3, states, in part:

> WF3 QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The WF3 Quality Assurance program applies to WF3 safety-related structures and components. Corrective actions and administrative (document) control for both safety-related and nonsafety related structures and components are accomplished in accordance with the established WF3 corrective action program and document control program. The confirmation process is part of the corrective action program…

3.0.4.2 Staff Evaluation

Pursuant to 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," 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. Table A.1-1,

“Elements of an Aging Management Program for License Renewal,” of Branch Technical Position RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7 – Corrective Actions, including root cause determination and prevention of recurrence, should be timely
- Attribute No. 8 – Confirmation Process, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective
- Attribute No. 9 – Administrative Controls, which should provide a formal review and approval process

The SRP-LR, Branch Technical Position IQMB-1, “Quality Assurance for Aging Management Programs,” 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, Quality Assurance program, may be used to address the elements of corrective action, confirmation process, and administrative control. Branch Technical Position 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, and Appendix B, Section B.0.3, 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 Branch Technical Position 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 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

Based on the staff’s evaluation of Appendix A, Section A.1, and Appendix B, LRA Section B.0.3, and the AMP program basis documents, the staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with SRP-LR, Branch Technical Position RLSB-1.

3.0.5 Operating Experience for Aging Management Programs

3.0.5.1 Summary of Technical Information in the Application

LRA Appendix A, “Final Safety Analysis Report Supplement,” Section A.1, “Aging Management Programs,” and LRA Appendix B, “Aging Management Programs and Activities,” Sections B.0.4, ”Operating Experience,” and B.1, “Aging Management Programs and Activities,” describe 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 to identify corrective actions that may result in program enhancements.

In a supplement to LRA Appendix A, Section A.1 (letter dated June 26, 2018, (ADAMS Accession No. ML18177A166) Entergy provided its consideration of the guidance contained in LR-ISG-2011-05, "Ongoing Review of Operating Experience," (ADAMS Accession No. ML12044A215). The supplement modified LRA Section A.1 to further address the guidance contained in LR-ISG-2011-05, Appendix A, “Areas of Further Review.” In addition, the applicant indicated that the program as described in LRA Appendix A and LRA Appendix B was currently in place and did not require further enhancements.

LRA Sections A.1 and B.0.4 state that the applicant does 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 the final LR-ISG-2011-05, “Ongoing Review of Operating Experience,” which includes interim revisions to the SRP-LR to clarify the criteria for the operating experience program element. SER Section 3.0.3 discusses the staff’s review of the second and third LR-ISG-2011-05 criteria, which concern currently available operating experience.

The following evaluation covers the staff’s review of the first LR-ISG-2011-05 criterion, which concerns the consideration of future operating experience.

3.0.5.2.2 Consideration of Future Operating Experience

The staff reviewed LRA Section A.1, “Aging Management Programs,” Section B.0.4, “Operating Experience,” and Section B.1, “Aging Management Programs and Activities,” to determine how the applicant will use future operating experience to ensure that the AMPs are effective. Each of the program descriptions in LRA Section B.1 indicate that LRA Section B.0.4 describes the process for review of future plant-specific and industry operating experience. 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, “Position” (as revised by LR-ISG-2011-05), 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 upon to meet the requirements of 10 CFR Part 50, Appendix B, and NUREG–0737, “Clarification of TMI Action Plan Requirements,” item I.C.5, “Procedures for Feedback of Operating Experience to Plant Staff.” SRP-LR Section A.4.2 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 GL 82-04, “Use of INPO SEE-IN Program,” dated March 9, 1982).

LRA Section A.1 and Section B.0.4 state that the applicant uses its operating experience program to systematically capture and review operating experience from plant-specific and industry sources. The applicant states 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.

LRA Section A.1 and Section B.0.4 state that site-specific and industry operating experience sources are systematically captured and reviewed on an ongoing basis in accordance with the QA program, which is consistent with Appendix B to 10 CFR Part 50, and the operating experience program, which is consistent with NUREG–0737, Item I.C.5. LRA Sections A.1 and B.0.4 state that the ongoing evaluation of operating experience included a review of corrective actions resulting in program enhancements. The LRA states that, for inspection programs, reports of recent inspections, examinations, and tests were reviewed to determine whether aging effects have been identified on applicable components. For monitoring programs, reports of sample results were reviewed to determine whether parameters are being maintained as required by the program. In addition, the LRA states that program owners contributed evidence of program success or weakness and identified applicable self-assessments, QA audits, peer evaluations, and NRC reviews.

Based on this information, the staff determined that the processes implemented under the QA program, the corrective action program, and the 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 QA program under 10 CFR Part 50, Appendix B, to include nonsafety-related SCs.

LRA Sections A.1 and B.0.3 state that the applicant’s QA program includes nonsafety-related SCs, which the staff finds consistent with the guidance in SRP-LR Section A.2 and, 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.0.3 relative to the application of the QA program to nonsafety-related SSCs.

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 A.1 states that the sources of external operating experience include active participation in the INPO operating experience program, GALL Report revisions, and other NRC review and guidance documentation.

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.0.4 states that the site-specific and industry operating experience items are screened to determine whether they involve lessons learned that may impact AMPs.

LRA Sections A.1 and B.0.4 state that internal and external operating experience is captured and systematically reviewed on an ongoing basis and that the operating experience program provides for evaluation of the effectiveness of their self-assessment process for each AMP described in the FSAR supplement. Site-specific and industry operating experience items are screened to determine whether they involve lessons learned that may impact AMPs. Items are evaluated, and affected AMPs are either enhanced or new AMPs are developed, as appropriate, when it is determined that the effects of aging are not adequately managed.

The staff finds the applicant's operating experience review processes acceptable because, after enhancement, these processes will 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's 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 any adverse trends should receive further evaluation.

LRA Section A.1 states that the corrective action includes aging type codes to identify either plant conditions related to aging or industry operating experience related to aging.

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 an operating experience evaluation finds that the effects of aging may not be adequately managed.

LRA Sections A.1 and B.0.4 state that the applicant's program requires that when evaluations indicate that the effects of aging are not being adequately managed the affected AMPs are either enhanced or new AMPs are developed, as appropriate.

The staff determined that the applicant's evaluations of age-related operating experience 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, would 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 are 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.

For inspection programs, the staff reviewed reports of recent inspections, examinations, or tests to determine whether aging effects have been identified on applicable components. For monitoring programs, the staff reviewed reports of sample results to determine whether parameters are being maintained as required by the program. In addition, program owners contributed evidence of program success or weakness and identified applicable self-assessments, QA audits, peer evaluations, and NRC reviews.

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 Sections A.1 and B.0.4 state that the operating experience program provides for that 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 for personnel responsible for implementing AMPs based on the complexity of the job performance requirements and assigned responsibilities.

The staff reviewed the LRA and determined that the scope of personnel included in the applicant's training program is consistent with the guidelines in SRP-LR Section A.4.2. The staff also determined that the applicant has demonstrated that its training program will cover age-related degradation and aging management topics. The applicant's 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 that the applicant's operating experience program is 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 on an ongoing basis throughout the term of the renewed license.

Sections A.1 and B.0.4 state that the applicant's self-assessment process provides for periodic evaluation of the effectiveness of this operating experience program described in the FSAR supplement. LRA Sections A.1 and B.0.4 state that the operating experience program will be implemented on an ongoing basis throughout the terms of the renewed licenses. LRA Section A.1 provides the FSAR supplement summary description of the applicant's enhanced programmatic activities for ongoing review of the operating experience. In accordance with 10 CFR 54.3(c), this summary description will be incorporated into the CLB upon issuance of the renewed licenses, and, 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 LRA review, 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 FSAR Supplement

In accordance with 10 CFR 54.21(d), the FSAR supplement must contain a summary description of the programs and activities for managing the effects of aging. LRA Section A.1 provides the FSAR supplement summary description of the applicant's programmatic activities for the ongoing review of operating experience, which will ensure that plant-specific and industry operating experience related to aging management will be used effectively.

The staff reviewed LRA Section A.1 and found that the summary description of the ongoing evaluation of operating experience related to aging management will consider (a) SSCs, (b) materials, (c) environments, (d) aging effects, (e) aging mechanisms, and (f) AMPs and that procedures will be revised to specify these evaluations.

Based on its review, the staff determined that the content of the applicant's summary description is consistent with the example and 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 FSAR 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 functions 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 FSAR 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, RVI, and RCS component groups of the following:

- reactor vessel (RV)
- reactor vessel internals (RVI)
- reactor coolant pressure boundary (RCPB)
- steam generators (SG)
- reactor coolant system (RCS) systems in scope for 10 CFR 54.4(a)(2)

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, RVI, and RCS component groups. LRA Table 3.1.1, "Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor vessel, RVI, and RCS 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

CRs 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 RV, RVI, RCPB, SGs, and RCS systems in scope for 10 CFR 54.4(a)(2), 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 WF3 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 and 3.1.2.1.3.

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	TLAA	Consistent with the GALL Report (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	Not Applicable to WF3	Not Applicable to WF3
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	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 (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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	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 (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	TLAA	Consistent with the GALL Report (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	TLAA	Consistent with the GALL Report (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	Not Applicable (BWR Only)	Not Applicable

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, detection of aging effects is to be evaluated	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report (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, item 1)
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	Consistent with the GALL Report (see SER Section 3.1.2.2.3, item 2)
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 to WF3	Not Applicable to WF3 (see SER Section 3.1.2.2.3, item 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 (BWR Only)	Not Applicable to PWRs (see SER Section 3.1.2.2.4, item 1)
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 (BWR Only)	Not Applicable to PWRs (see SER Section 3.1.2.2.4, item 2)
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 to WF3	Not Applicable to WF3 (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, plant-specific	One-Time Inspection	Consistent with the GALL Report (see SER Section 3.1.2.2.6, item 1)
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, plant-specific	Inservice Inspection, Thermal Aging Embrittlement of CASS, and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report (see SER Section 3.1.2.2.6, item 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
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 (BWR Only)	Not Applicable to PWRs (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, plant-specific	Not Applicable to WF3	Not Applicable to WF3 (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, plant-specific	Steam Generator Integrity and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report (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 to WF3: The reactor vessel internals design does not include thermal shield positioning pins.	Not Applicable to WF3 (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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable to PWRs (see SER Section 3.1.2.1.1)
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 Used	Not Used
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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	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, 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 Used. (the applicant alternatively uses Item 3.1.1-80 to manage cracking in the pressurizer relief tank)	Not Used (see SER Section 3.1.2.1.3 for the staff’s assessment of item 3.1.1-80)
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	Inservice Inspection	Consistent with the GALL Report
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	Inservice Inspection	Consistent with the GALL Report
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	Inservice Inspection	Consistent with the GALL Report
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	Inservice Inspection	Consistent with the GALL Report
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	Inservice Inspection, Water Chemistry Control – Primary and Secondary, and One-Time Inspection – Small-Bore 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
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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
Nickel alloy core support pads; core guide lugs exposed to reactor coolant (3.1.1-40.5)	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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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 (BWR Only)	Not Applicable
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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable
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	Inservice 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
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	Inservice Inspection, Nickel Alloy Inspection, and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report (see SER Section 3.1.2.1.2)
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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report (see SER Section 3.1.2.1.2)
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	Inservice Inspection and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Boric Acid Corrosion and Nickel Alloy 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 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	Boric Acid Corrosion	Consistent with the GALL Report
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	Thermal Aging Embrittlement of CASS	Consistent with the GALL Report
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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	Reactor Vessel Internals and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Reactor Vessel Internals and Water Chemistry Control – Primary and Secondary	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 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	Reactor Vessel Internals and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The Combustion Engineering designed reactor vessel does not use bottom mounted instrument system flux thimble tubes.	Not Applicable to WF3

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 “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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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	Reactor Vessel Internals and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3

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 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	Reactor Vessel Internals	Consistent with the GALL Report
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	Reactor Vessel Internals	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 (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	Reactor Vessel Internals	Consistent with the GALL Report
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
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3

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 “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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3

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) 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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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 to WF3: The WF3 reactor vessel internals were designed by Combustion Engineering.	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable

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 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	Flow- Accelerated Corrosion	Consistent with the GALL Report
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	Bolting Integrity	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable
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	Bolting Integrity	Consistent with the GALL Report
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 to WF3: WF3 does not use bolting for the control rod drive head penetration flange.	Not Applicable to WF3
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	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 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 to WF3: The WF3 replacement steam generators do not use carbon steel tube support plates.	Not Applicable to WF3 (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	Steam Generator Integrity and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Steam Generator Integrity and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Steam Generator Integrity and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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	Steam Generator Integrity and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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 to WF3: WF3 does not use phosphate chemistry in the secondary feedwater.	Not Applicable to WF3 (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 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 to WF3: The WF3 replacement steam generator steel feedwater piping components are composed of alloy steel (Cr-Mo) which is resistant to FAC.	Not Applicable to WF3 (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 to WF3: The WF3 replacement steam generators do not use carbon steel tube support lattice bars.	Not Applicable to WF3 (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	Steam Generator Integrity	Consistent with the GALL Report
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	Steam Generator Integrity	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable

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 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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with GALL Report (see SER Section 3.1.2.1.3)
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 to WF3: The pressurizer spray head components are made of nickel alloy.	Not Applicable to WF3
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable

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 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 to WF3: The steam generator primary side divider plate is made of nickel alloy (Alloy 690).	Not Applicable to WF3
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable
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	Reactor Head Closure Studs	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 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	Selective Leaching	Consistent with the GALL Report
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable

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 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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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 operating experience indicates no degradation of the concrete	No, if conditions are met.	Not Applicable to WF3: No steel reactor coolant system or reactor coolant pressure boundary piping components are embedded in concrete.	Not Applicable to WF3

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 piping, piping components, and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage (3.1.1-106)	None	None	No	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	No	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 (BWR Only)	Not Applicable

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 RV, RVI, and RCS components:

- Bolting Integrity
- Boric Acid Corrosion
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Inservice Inspection
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Nickel Alloy Inspection
- Oil Analysis
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Periodic Surveillance and Preventive Maintenance
- Reactor Head Closure Studs
- Reactor Vessel Internals

- Reactor Vessel Surveillance
- Selective Leaching
- Steam Generator Integrity
- Thermal Aging Embrittlement of CASS
- Water Chemistry Control – Closed Treated Water Systems
- Water Chemistry Control – Primary and Secondary

LRA Tables 3.1.2-1 through 3.1.2-5-2 summarize the AMR results for the RV, RVI, RCPB, SGs, and RCS systems in scope for 10 CFR 54.4(a)(2), 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 3.1.1-6, 3.1.1-7, 3.1.1-11, 3.1.1-16, 3.1.1-17, 3.1.1-21, 3.1.1-29, 3.1.1-30, 3.1.1-31, 3.1.1-41, 3.1.1-43, 3.1.1-60, 3.1.1-63, 3.1.1-79, 3.1.1-84, 3.1.1-85, 3.1.1-91, 3.1.1-94, 3.1.1-95, 3.1.1-96, 3.1.1-97, 3.1.1-98, 3.1.1-99, 3.1.1-100, 3.1.1-101, 3.1.1-102, 3.1.1-103, 3.1.1-104, and 3.1.1-110, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to boiling water reactors (BWRs). The staff reviewed the SRP-LR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to WF3, which is a CE PWR.

For LRA Table 3.1.1, items 3.1.1-23, 3.1.1-24, 3.1.1-26, 3.1.1-27, 3.1.1-57, 3.1.1-108, and 3.1.1-109, the applicant stated that these items are not in the SRP-LR as modified by ISGs and are therefore not applicable. The staff reviewed the GALL Report, as modified by ISGs, and confirmed that these items have been removed and are therefore not applicable to WF3.

For LRA Table 3.1.1, items 3.1.1-4, 3.1.1-15, 3.1.1-22, 3.1.1-34, 3.1.1-51a, 3.1.1-51b, 3.1.1-53a, 3.1.1-53b, 3.1.1-53c, 3.1.1-54, 3.1.1-55a, 3.1.1-55c, 3.1.1-58a, 3.1.1-58b, 3.1.1-59a, 3.1.1-59b, 3.1.1-59c, 3.1.1-65, 3.1.1-68, 3.1.1-73, 3.1.1-75, 3.1.1-81, 3.1.1-86, 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 WF3. The staff reviewed the LRA and FSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

For the LRA Table 3.1.1 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 FSAR or issued one or more RAIs, or both, to verify the applicant's claim of non-applicability.

LRA Table 3.1.1, item 3.1.1-28, addresses stainless steel CE "Existing Programs" components exposed to reactor coolant and neutron flux. The GALL Report recommends GALL Report AMPs XI.M16A, "PWR Vessel Internals," and XI.M2, "Water Chemistry" (for SCC mechanisms only) to manage cracking due to SCC, irradiation-assisted SCC or fatigue, and loss of material due to wear. The applicant stated that this item is not applicable because the reactor vessel internals design does not include thermal shield positioning pins. The staff evaluated the applicant's claim and finds it acceptable because based on an LRA and FSAR review, the RVI design does not include thermal shield positioning pins.

LRA Table 3.1.1, item 3.1.1-74, addresses wall thinning due to flow-accelerated corrosion (FAC) in steel SG upper assembly and separators, including feedwater inlet ring and support exposed to secondary feedwater or steam. LRA item 3.1.1-74 also refers to the aging management

guidance in SRP-LR Table 3.1-1, AMR item 74, stating that the aging effect is managed by using GALL Report AMP XI.M19, “Steam Generators,” and AMP XI.M2, “Water Chemistry.” LRA item 3.1.1-74 further states that the steel feedwater piping components of the WF3 replacement SGs are composed of alloy steel (Cr-Mo), which is resistant to FAC.

In comparison, the staff noted that GALL Report AMP XI.M17, “Flow-Accelerated Corrosion,” states that Nuclear Safety Analysis Center (NSAC)-202L-R2 or R3 reports provide general guidelines for the FAC program. The staff also noted that Section 4.2.2 of NSAC-202L-R2 indicates that stainless steel or low-alloy steel piping with nominal chromium content equal to or greater than 1.25 percent is resistant to FAC. The staff further noted that the LRA does not describe a sufficient technical basis for the applicant’s claim that the replacement SG feedwater piping components are resistant to FAC (e.g., chromium content of the Cr-Mo steel).

By letter dated October 12, 2016, the staff issued RAI 3.1.1.74-1 requesting that the applicant provide information to demonstrate that the steel feedwater piping components in the SG are resistant to FAC (e.g., chromium content of the alloy steel to support material resistance to FAC). The staff also requested that if the chromium content of the alloy steel used to fabricate these components is below the threshold described in NSAC-202L-R2, the applicant should provide justification for why these feedwater piping components are resistant to FAC.

In its response dated November 10, 2016, the applicant stated that feedwater piping components exposed to secondary feedwater or steam in the SGs are fabricated from alloy steel with a chromium content of 1.25 percent or greater. The applicant also indicated that, in accordance with Section 4.2.2 of NSAC-202L-R2, low-alloy steel piping with nominal chromium content equal to or greater than 1.25 percent is resistant to FAC. In its review, the staff finds the applicant’s response acceptable because the applicant demonstrated that the alloy steel material used to fabricate its feedwater piping components had a chromium content (equal to or greater than 1.25 percent) that would provide resistance to FAC, consistent with the guidance in GALL Report AMP XI.M17. The staff’s concern described in RAI 3.1.1.74-1 is resolved.

As discussed above, the staff evaluated the applicant’s claim that the steel feedwater piping components of the replacement SGs are composed of alloy steel that is resistant to FAC. The staff finds it acceptable because the applicant clarified that the alloy steel used to fabricate these components has a chromium content sufficient to provide resistance to FAC.

3.1.2.1.2 Cracking Due to Primary Water Stress Corrosion Cracking

LRA Table 3.1.1, items 3.1.1-45 and 3.1.1-46 address PWR nickel alloy and steel with nickel alloy cladding components that are located in the RCPB and are exposed on their internal surfaces to reactor coolant. The LRA also indicates that the RCPB components associated with LRA items 3.1.1-45 and 3.1.1-46 will be managed for cracking due to PWSCC.

For the AMR items that cite generic note E, the LRA credits the Inservice Inspection program (LRA AMP B.1.15) and Water Chemistry Control – Primary and Secondary program (LRA AMP B.1.41) to manage cracking for the following nickel alloy components or steel components that are fabricated with internal nickel alloy cladding: (a) vent pipe nozzle, control element drive mechanism (CEDM) nozzles, and ICI nozzles in the upper reactor vessel closure head (URVCH); (b) CEDM motor housing lower end fittings; (c) flow orifices; (d) RCS hot leg overlay welds; (e) pressurizer instrumentation nozzles, including instrument sleeve welds and nozzle-to-safe-end weld overlays; (f) pressurizer heater plugs, heater sleeves, and heater

sleeve-to-sheath welds; (g) thermowells; and (h) SG primary side pressure nozzles, including nozzle-to-SG vessel welds.

The GALL Report recommends the use of GALL Report AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD;” AMP XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in RCPB Components (PWRs Only);” and AMP XI.M2, “Water Chemistry,” to provide reasonable assurance that this aging effect is adequately managed.

GALL Report AMP XI.M1 recommends use of condition monitoring methods in the ASME Code Section XI (e.g., periodic inspections specified in ASME Code Section XI, Subsections IWA and IWB, for ASME Code Class 1 components) to manage cracking in these RCPB components. GALL Report AMP XI.M11B recommends the use of the inspections required in 10 CFR 50.55a, “Codes and Standards,” to manage cracking in nickel alloy RCPB components. Specifically, GALL Report AMP XI.M11B references the use of the following ASME Code Cases that are incorporated by reference in 10 CFR 50.55a for mandatory implementation: (a) Code Case N-729-1, (b) ASME Code Case N-722-1, and (c) ASME Code N-770-1. GALL Report AMP XI.M2 performs water chemistry control to limit the concentrations of organic and inorganic impurities in the reactor coolant that, if present in high concentrations, can promote initiation or growth of environmentally assisted cracking (e.g., PWSCC) in the components.

The staff’s evaluation of the applicant’s Inservice Inspection program (the AMP corresponds to GALL Report AMP XI.M1) is documented in SER Section 3.0.3.1.5. The Inservice Inspection program proposes to manage the effects of aging for ASME Code Class 1, 2, and 3 components through the use of condition monitoring methods, include VT-1, VT-2, and VT-3 visual examination techniques, volumetric examination techniques (e.g., UT, radiography, or eddy current testing), or surface inspection techniques (e.g., penetrant test or magnetic particle testing).

The staff’s evaluation of the applicant’s Water Chemistry Control – Primary and Secondary program (the AMP corresponds to GALL Report AMP XI.M2) is documented in SER Section 3.0.3.1.19. For components in the RCS, the Water Chemistry Control – Primary and Secondary program proposes to manage the effects of aging induced by corrosive aging mechanisms (including cracking induced by a PWSCC mechanism) through the use of preventative monitoring activities designed to minimize concentrations of impurities that may be present in reactor coolant and through the use of mitigative monitoring activities designed to control the concentration of chemical additives in the reactor coolant.

The staff found that the applicant’s proposal to use the Inservice Inspection program and Water Chemistry Control – Primary and Secondary program is adequate for aging management because the basis is consistent with the referencing of these AMPs for aging management in SRP-LR Table 3.1-1, AMR items 45 and 46.

The staff noted that the applicant’s AMR items for these components do not use the applicant’s Nickel Alloy Inspection program (the AMP that corresponds to GALL Report AMP XI.M11B) to manage cracking for the components. In plant-specific note 103 for the AMR items, the applicant further clarified that the Nickel Alloy Inspection program is not credited for management of cracking because the applicant does not consider the improved nickel alloy materials (e.g., Alloy 690 base metal materials or Alloy 52, 152, or 52/152 weld materials) used in the repairs or replacements of the components to be susceptible to PWSCC-induced cracking.

During its review, the staff noted that the applicant's reference to generic note E and information in plant-specific note 103 did not provide sufficient justification for not crediting the Nickel Alloy Inspection program for these components because the scope of GALL Report AMP XI.M11B applies to components in the RCPB made with all types of nickel alloy materials, including Alloy 600 and Alloy 690 materials and associated nickel alloy weld filler materials (i.e., Alloys 82 and 182 and Alloys 52 and 152). The staff also noted the requirements in 10 CFR 50.55a, paragraphs (g)(6)(ii)(D), (E), and (F) require the applicant to implement the augmented inspections for ASME Code Class 1 nickel alloy components defined and described in ASME Code Cases N-729-1, N-722-1, and N-770-1. Therefore, the staff found that, in order to determine the adequacy of the AMR items based on generic note E and plant-specific note 103, the Inservice Inspection program for the LRA would need to implement all of these ASME Code Cases in compliance with the conditions for implementing the Code Cases in 10 CFR 50.55a, Paragraphs (g)(6)(ii)(D), (E), and (F).

During the AMP audit of July 25 – 29, 2016, the staff confirmed that the scope of the applicant's Inservice Inspection program includes activities to implement the condition monitoring techniques that are defined for ASME Code Class 1 nickel alloy components in ASME Code Cases N-729-1, N-722-1, and N-770-1 and that these activities are defined to comply with the augmented inspection requirements for these type of components in 10 CFR 50.55a, paragraphs (g)(6)(ii)(D), (E), and (F).

Based on its review of components associated with items 3.1.1-45 and 3.1.1-46, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the cracking due to PWSCC using a combination of the Inservice Inspection program and Water Chemistry Control – Primary and Secondary program acceptable because: (a) the crediting of the Water Chemistry Control – Primary and Secondary program for aging management is consistent with the AMR basis in items 45 and 46 of SRP-LR Table 3.1-1, and (b) implementation of the Inservice Inspection program will implement the same ASME Code Cases (i.e., Code Cases N-729-1, N-722-1, and N-770-1) for aging management referenced for use in GALL Report AMP XI.M11B, "Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in RCPB Components (PWRs Only)."

3.1.2.1.3 Cracking Due to Stress Corrosion Cracking

LRA Table 3.1.1, item 3.1.1-20, addresses CASS piping exposed to treated borated water greater than 140 °F, which will be managed for cracking due to SCC. For the AMR items that cite generic note E, the LRA credits the Inservice Inspection program, Thermal Aging Embrittlement of CASS program, and the Water Chemistry – Primary and Secondary program to manage the aging effect for Class 1 CASS piping, piping components, and piping elements exposed to reactor coolant. In order to manage the aging effect, the GALL Report recommends monitoring and control of primary water chemistry to minimize the potential for SCC. However, SCC could occur in Class 1 CASS components that do not meet the NUREG–0313 guidelines with regard to ferrite and carbon content, for which the GALL Report recommends a plant-specific program to manage this aging effect. This plant-specific program should include: (a) adequate inspection methods to ensure detection of cracks and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement to manage the effects of aging.

As discussed in SER Section 3.1.2.2.6, item 2, the staff notes that the applicant proposes to manage the effects of aging using: (a) the Water Chemistry – Primary and Secondary program to monitor and control the primary water chemistry to minimize the potential for SCC consistent

with the GALL Report; (b) the Inservice Inspection program, when enhanced, to provide adequate inspection methods to ensure detection of cracking due to SCC; and (c) the Thermal Aging Embrittlement of CASS program to identify and provide flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement and manage the effects of aging. Therefore, based on its review of components associated with item 3.1.1-20 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using these programs acceptable.

The staff's evaluations of the applicant's Water Chemistry – Primary and Secondary program, Inservice Inspection program, and Thermal Aging Embrittlement of CASS program are documented in SER Sections 3.0.3.1.19, 3.0.3.1.5, and 3.0.3.1.18, respectively.

The staff concludes that for LRA item 3.1.1-20, 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 3.1.1, item 3.1.1-80, addresses stainless steel or steel with stainless steel cladding pressurizer relief tanks (non-ASME Code Section XI tank shells, heads, flanges, and nozzles) exposed to treated borated water greater than 60 °C (140 °F), which will be managed for cracking due to SCC. For the AMR items associated with item 3.1.1-80, the LRA credits the Water Chemistry Control – Primary and Secondary program and One-Time Inspection program to manage the aging effect for these components. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and AMP XI.M32, "One-Time Inspection." GALL Report AMP XI.M2 recommends using water chemistry control to manage aging by limiting the concentrations of chemical species that can cause SCC within the acceptable ranges. In addition, GALL Report AMP XI.M32, "One-Time Inspection," confirms the effectiveness of the Water Chemistry program for adequate aging management of cracking due to SCC.

During its review, the staff noted that LRA Table 3.1.2-5-1 describes detailed AMR results (called Table 2 items) for nonsafety-related components affecting safety-related systems in the RCS. Although LRA Table 3.1.2-5-1 includes Table 2 AMR items for nonsafety-related tanks, these items for tanks do not address aging management of cracking in the pressurizer relief tank. Therefore, additional information was necessary to confirm which Table 2 AMR item is used to manage cracking due to SCC for the pressurizer relief tank.

By letter dated October 12, 2016, the staff issued RAI 3.1.1.34-1 requesting that the applicant clarify why the AMR results for tanks in LRA Table 3.1.2-5-1 do not address cracking due to SCC for the pressurizer relief tank. The staff also requested that the applicant clarify which LRA table (e.g., Table 3.1.2-X) includes a Table 2 AMR item used to manage cracking due to SCC for the pressurizer relief tank and associated components.

In its response dated November 10, 2016, the applicant stated that the pressurizer relief tank operates at containment ambient temperature that is normally below 140 °F. The applicant also indicated that since the threshold for SCC in stainless steel components is 140 °F, cracking due to SCC is not an AERM for the pressurizer relief tank. The staff finds the applicant's response acceptable because the applicant clarified that the normal temperature of the pressurizer relief tank is below 140 °F, which is not conducive to SCC. The staff's concern described in RAI 3.1.1.34-1 is resolved.

During its review related to LRA item 3.1.1-80, the staff noted that LRA Table 3.1.2-3 describes AMR results for RCPB components. LRA Table 3.1.2-3 indicates that the following non-Class 1 component types are associated with LRA item 3.1.1-80 and are susceptible to SCC: (a) valve body, (b) piping, (c) tubing, and (d) flow element. However, the staff noted that the LRA does not clearly indicate whether these non-Class 1 components are ASME Code Class components that are subject to the existing periodic ISIs specified in ASME Code Section XI (e.g., ASME Code Class 2 or 3 components). Therefore, additional information was necessary to clearly identify aging management activities for these non-Class 1 components.

By letter dated October 12, 2016, the staff issued RAI 3.1.1.80-1 requesting that the applicant clarify whether the non-Class 1 components discussed above are ASME Code Class components subject to the existing periodic ISIs. If these components are ASME Code Class components, the staff requested that the applicant justify why the LRA does not identify periodic ISIs for these components in the AMR results.

In its response dated November 10, 2016, the applicant indicated that the non-Class 1 components represented by the valve body, piping, tubing, and flow element items in LRA Table 3.1.2-3 represent Class 2, Class 3 and non-ASME Section XI components that are less than 4-inch NPS. The applicant also stated that these components are not subject to periodic volumetric or surface examination under the Inservice Inspection program. The staff finds this portion of the response acceptable because (1) the applicant clarified that these components less than 4 NPS are not subject to periodic volumetric or surface inspections under the Inservice Inspection program and (2) this clarification supports the applicant’s use of the One-Time Inspection program (rather than the Inservice Inspection program) in order to confirm the effectiveness of the Water Chemistry Control – Primary and Secondary program.

The applicant also indicated that, if these non-Class 1 components are associated with LRA item 3.1.1-80, confusion may occur because LRA item 3.1.1-80 addresses ASME Code Class 1 components. Therefore, the applicant stated that LRA Table 3.1.2-3 is revised to indicate these non-Class 1 components are associated with item 3.2.1-20 (rather than item 3.1.1-80). The applicant also revised Table 2 items for these components accordingly (i.e., change in the corresponding Table 2 item from IV.C2.RP-383 to V.A.E-12).

The staff noted that Table 1, item 3.2.1-20,addresses aging management of cracking due to SCC for stainless steel piping, piping components, and piping elements exposed to treated water greater than 60 °C (140 °F), using the Water Chemistry Control – Primary and Secondary program and One-Time Inspection program (as indicated by plant-specific note 201). The staff finds the applicant’s revision acceptable because the revision is consistent with the applicant’s clarification that these components are not ASME Code Class 1 components and the One-Time Inspection program can confirm the effectiveness of the Water Chemistry Control – Primary and Secondary program to manage cracking due to SCC for these piping components. The staff’s concern described in RAI 3.1.1.80-1 is resolved.

During its review, the staff noted that LRA Section 2.3.1.3 (page 2.3-14) indicates that the RCP thermal barrier heat exchanger is part of the RCPB and is subject to an AMR. The staff also noted that WF3 FSAR Section 5.2.5.1.5, “Heat Exchanger,” indicates that leakage of reactor coolant through the RCP thermal barrier can be detected by the monitoring of CCW radiation and surge tank level.

However, the staff noted that the LRA does not clearly identify which AMR item is used to manage cracking in the thermal barrier heat exchanger tubes. The staff also noted that the LRA

does not address whether the applicant's operating experience confirms that cracking is not occurring in the thermal barrier heat exchanger. By letter dated October 12, 2016, the staff issued RAI 3.1.1.81-1 requesting that the applicant clarify which AMR item is used to manage cracking for the RCP thermal barrier heat exchanger tubes. The applicant was also requested to clarify whether the applicant's operating experience confirms that cracking is not occurring in the heat exchanger tubes.

In its response dated November 10, 2016, the applicant clarified that the RCP thermal barrier heat exchanger is represented in LRA Table 3.1.2-3 by the component type "Heat exchanger – water jacket (seal heat exchanger)." The applicant also indicated that the thermal barrier heat exchanger does not use tubes and is configured as a series of concentric interlacing baffle plates that form flow channels. The applicant further stated that the operating experience review found no evidence of cracking in these plates.

In its review of the applicant's response, the staff noted that the component type, which the applicant discussed, is associated with LRA item 3.1.1-33. This LRA item credits the Inservice Inspection program and Water Chemistry Control – Primary and Secondary program to manage cracking due to SCC. However, it was not clear to the staff what inspection activities are performed to manage this aging effect for the thermal barrier heat exchanger under the Inservice Inspection program. By letter dated December 19, 2016, the staff issued RAI 3.1.1.81-1a requesting that the applicant describe what inspection activities are performed to manage cracking due to SCC for the thermal barrier heat exchanger components under the Inservice Inspection program.

In its response dated February 1, 2017, the applicant indicated that leakage testing of ASME Code Class 1 components is performed by visual inspection (VT-2) following each refueling outage as required by station procedures and ASME Code. The applicant also stated that the examination will detect external leakage from the RCP and associated RCPB components. In addition, the applicant stated that the Inservice Inspection program includes numerous NDEs of stainless steel components in the RCS that serve to verify effectiveness of the Water Chemistry Control – Primary and Secondary program in managing the effects of aging.

The applicant further indicated that radiation detectors also monitor radiation levels in the CCW system as described in FSAR Section 11.5.2.4.2.2. The applicant also stated that monitoring radiation levels is an effective means of detecting leakage that could indicate cracking due to SCC in the thermal barrier heat exchanger.

In its review, the staff finds the applicant's response acceptable because the applicant clarified that (1) the Inservice Inspection program uses leakage testing and associated visual inspections to confirm the effectiveness of water chemistry control and the integrity of the thermal barrier heat exchanger as specified in ASME Code Section XI; and (2) the radiation levels are also monitored in the CCW system as described in the FSAR, which can detect leakage due to SCC in the thermal barrier heat exchanger. The staff's concern described in RAIs 3.1.1.81-1 and 3.1.1.81-1a is resolved.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program, One-Time Inspection program, and Inservice Inspection program are documented in SER Sections 3.0.3.1.19, 3.0.3.1.13. and 3.0.3.1.5, respectively. The Water Chemistry Control – Primary and Secondary program manages the effects of aging for the stainless steel piping, piping components, and piping elements of the RCS through water chemistry monitoring and control of known detrimental contaminants known to cause SCC (such as chloride, fluoride, and

sulfate) below established limits. The One-Time Inspection program performs a one-time inspection of the representative sample size (i.e., 20 percent of the population) to confirm that unacceptable aging-related degradation due to SCC is not occurring. The Inservice Inspection program includes visual, surface, and volumetric inspections that are adequate to detect and manage cracking due to SCC.

Based on its review of components associated with item 3.1.1-80, for which the applicant cited generic note C, the staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Primary and Secondary program and One-Time Inspection program acceptable because the Water Chemistry Control – Primary and Secondary program limits the concentrations of chemical species known to cause SCC within the acceptable ranges to minimize the environmental effect on SCC, and the One-Time Inspection program includes a one-time inspection of representative components to confirm the effectiveness of the Water Chemistry Control – Primary and Secondary program.

Based on its review of components associated with item 3.1.1-33, for which the applicant cited generic note C, the staff finds the applicant's proposal to manage aging using the Water Chemistry Control – Primary and Secondary program and Inservice Inspection program acceptable because the Water Chemistry Control – Primary and Secondary program limits the concentrations of chemical species known to cause SCC within the acceptable ranges as discussed above, and the Inservice Inspection program includes leak testing and associated visual inspections to confirm the effectiveness of the Water Chemistry Control – Primary and Secondary program and the integrity of the components.

The staff concludes that for LRA items 3.1.1-80 and 3.1.1-33 discussed above, 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 RVI and RCS 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 intergranular stress corrosion cracking (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 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, 3.1.1-2, 3.1.1-3, 3.1.1-5, 3.1.1-8, 3.1.1-9, and 3.1.1-10, states that the effects of cumulative fatigue damage due to fatigue of reactor vessel, reactor vessel internals, and RCPB components will be evaluated as a TLAA. The LRA further states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of these TLAAs are addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.1.2.2.1 and is, therefore, acceptable. The staff's evaluation of these TLAAs for cumulative fatigue damage are documented in SER Section 4.3.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

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 due to general, pitting, and crevice corrosion for the steel SG upper and lower shell and transition cone exposed to secondary feedwater and steam. The applicant indicated that this aging effect is managed by the Inservice Inspection program and Water Chemistry Control – Primary and Secondary program.

The criteria in SRP-LR Section 3.1.2.2.2, item 1, state that loss of material due to general, pitting, and crevice corrosion could occur for steel SG upper and lower shells and transition cones exposed to secondary feedwater and steam. The SRP-LR also indicates that, as discussed in IN 90-04, the existing Inservice Inspection program may not be sufficient to detect pitting and crevice corrosion if general and pitting corrosion of the shell is known to occur. As described in the SRP-LR, the GALL Report recommends augmented inspection to manage this aging effect and further clarifies that this issue is limited to Westinghouse Model 44 and 51 SGs where a high-stress region exists at the shell to transition cone weld. The applicant addressed these further evaluation criteria of the SRP-LR by stating that its SGs have been replaced with Westinghouse Model Delta-110 SGs.

The staff's evaluations of the applicant's Inservice Inspection program and Water Chemistry Control – Primary and Secondary program are documented in SER Sections 3.0.3.1.5 and 3.0.3.1.19, respectively. In its review of components associated with item 3.1.1-12, the staff finds that the applicant has met the further evaluation criteria and the applicant's proposal to manage the effects of aging using these programs is acceptable because (1) the Inservice Inspection program includes volumetric examination to confirm that the integrity of the SG shell is adequately maintained by detecting and monitoring potential flaws, (2) the Water Chemistry Control – Primary and Secondary program monitors and controls the secondary water chemistry conditions to minimize environmental effects on aging degradation in these components, (3) the use of these programs is consistent with the guidance in the GALL Report, and (4) the applicant's SGs (Westinghouse Model Delta-110) are not based on an SG design (Model 44 or 51) that may warrant additional inspections in accordance with SRP-LR Section 3.1.2.2.2, item 1.

Based on the programs identified, the staff determines that the applicant's programs meet the criteria of SRP-LR Section 3.1.2.2.2, item 1. For those items associated with LRA Section 3.1.2.2.2, item 1, the staff concludes that the LRA is consistent with the GALL Report

and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 3.1.2.2.2, item 2, associated with LRA Table 3.1.1, item 3.1.1-12, addresses loss of material due to general, pitting, and crevice corrosion for the new transition cone closure weld exposed to secondary feedwater and steam. The criteria in SRP-LR Section 3.1.2.2.2, item 2, indicate that this item is applied to a partially replaced SG that has a replaced bottom part by generating a cut in the middle of the transition cone and a new transition cone closure weld. In the LRA, the applicant indicated that this item is not applicable because this item pertains only to plants where partial SG replacements have been made. The staff evaluated the applicant’s claim and finds it acceptable because the applicant confirmed that its SGs have not been partially replaced and do not require the further evaluation specified in SRP-LR Section 3.1.2.2.2, item 2.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

Item 1. LRA Section 3.1.2.2.3, item 1, associated with LRA table 3.1.1, item 3.1.1-13, states that TLAAs for evaluating loss of fracture toughness due to neutron irradiation embrittlement in ferritic components of the reactor pressure vessel (RPV) are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluations of these TLAAs are addressed in Section 4.2. The applicable TLAAs are described in the following LRA sections: (a) Section 4.2.1, “Reactor Vessel Fluence”; (b) Section 4.2.2, “Upper Shelf Energy”; (c) Section 4.2.3, “Pressurized Thermal Shock”; (d) Section 4.2.4, “Pressure-Temperature Limits”; and (e) Section 4.2.5, “Low Temperature Overpressure Protection (LTOP) Setpoints.”

The identification of these TLAAs is consistent with SRP-LR Section 3.1.2.2.3, item 1 and is, therefore, acceptable. The staff’s evaluations of these neutron embrittlement TLAAs are further documented in SER Section 4.2.

The applicant stated that the RPV components addressed in LRA Section 3.1.2.2.3 are associated with AMR items in LRA Table 3.1.1, item 3.1.1-13, and in LRA Table 3.1.2-1 (LRA page 3.1-56). The staff noted that the applicant’s AMR results appropriately identify those ferritic RPV components, including those in the upper, intermediate, and lower RPV shells. The staff also confirmed that the applicant’s AMR items are consistent with SRP-LR Table 3.1-1, item 13 and GALL Report item IV.A2.R-84. The staff finds the applicant-identified AMR items acceptable because they are in compliance with the RPV component scoping requirements specified in 10 CFR Part 50, Appendix G, and 10 CFR 50.61 rules and are consistent with the corresponding AMR items for these components in the GALL Report and SRP-LR.

GALL Report Table IV.A2 includes item IV.A2.R-81 for evaluating loss of fracture toughness in PWR RPV inlet, outlet, and safety injection nozzles using these types of TLAAs. The regulation in 10 CFR Part 50, Appendix H, establishes a neutron fluence of 1×10^{17} n/cm^2 (E > 1.0 MeV) as the threshold for determining when a ferritic RPV shell, nozzle, or weld component will need to be evaluated for changes in fracture toughness. Based on this criterion, the AMR in GALL Report item IV.A2.R-81 assumes that the neutron fluence levels for PWR RPV inlet, outlet, and safety injection nozzles may exceed this threshold value at the end of the period of extended operation and that these nozzles may need to be included within the scope of the neutron-embrittlement TLAAs listed above for PWR-designed facilities.

The staff noted that the LRA did not include a TLAA-related AMR item for these RPV nozzle components or evaluate these nozzle components in the TLAAs provided in LRA Section 4.2. However, during the AMP audit (July 25-28, 2016), the applicant provided the staff with onsite documentation which demonstrates the projected neutron fluence for these nozzles will be less than 1×10^{17} n/cm^2 (E greater than 1.0 MeV) at the end of the period of extended operation. Therefore, based on this assessment, the staff concludes that the LRA does not need an AMR item that would include the nozzles in the evaluations of the neutron embrittlement TLAAs in the LRA because the applicant has sufficient demonstration that the neutron fluence projected for these nozzles at the expiration of the period of extended operation will be less than the threshold fluence value stated in 10 CFR Part 50, Appendix H (i.e., 1×10^{17} n/cm^2 for $E > 1.0$ MeV).

In its review of the components associated with LRA item 3.1.1-13, the staff finds that the applicant has met the further evaluation criteria, and the applicant's basis for evaluating these components in accordance with the TLAAs on neutron irradiation embrittlement is acceptable because the basis is consistent with the guidelines in SRP-LR Section 3.1.2.2.3, item 1, and the AMR criteria in SRP-LR Table 3.1-1, item 13, and GALL Report item IV.A2.R-84.

Item 2. LRA Section 3.1.2.2.3, item 2, associated with LRA Table 3.1.1, item 3.1.1-14, addresses RPV shell, nozzle, and weld components that are made from ferritic steel materials and exposed to a reactor coolant and neutron flux environment, and will be managed for loss of fracture toughness due to neutron irradiation embrittlement by the Reactor Vessel Surveillance program. The criteria in SRP-LR Section 3.1.2.2.3, item 2, states that loss of fracture toughness due to neutron irradiation embrittlement could occur for RPV components that are made from stainless steel and are exposed to a reactor coolant with neutron flux environment. The SRP-LR states that a RPV materials surveillance program is used to monitor neutron irradiation embrittlement of the RPV. The SRP-LR also states that, in accordance with the requirements in 10 CFR Part 50, Appendix H, an applicant is required to submit any proposed RPV surveillance capsule withdrawal schedule, or any changes to the existing withdrawal schedule, for staff approval prior to implementation. Thus, the SRP-LR recommends further staff evaluation be performed for license renewal.

The applicant stated that, consistent with these SRP-LR guidelines, the Reactor Vessel Surveillance program (LRA AMP B.1.34) will be used to manage reduction in fracture toughness due to neutron embrittlement of RPV beltline components. The applicant stated that the AMP is designed to monitor changes in the fracture toughness properties of components that are made from ferritic steel materials and are located in the beltline region of the RPV.

The applicant stated that, as described in LRA Appendix B, the Reactor Vessel Surveillance program is consistent with the program described in GALL Report AMP XI.M31, "Reactor Vessel Surveillance," including recommendations to submit the proposed withdrawal schedule for approval prior to implementation. The staff's evaluation of the applicant's Reactor Vessel Surveillance program is documented in SER Section 3.0.3.1.15.

In LRA Table 3.1.2-1 (page 3.1-56), the applicant included relevant AMR items for RPV components associated with LRA item 3.1.1-14. The staff noted that the AMR items appropriately include those ferritic RPV base metal and weld components located in the beltline region of the RPV, including those in the upper, intermediate, and lower shells of the RPV. The staff also confirmed that the applicant's AMR items are consistent with SRP-LR Table 3.1-1, item 14, and GALL Report Table IV.A2, item IV.A2.RP-229. The staff finds the LRA AMR items acceptable because they are in compliance with the component scoping requirements specified

in the 10 CFR Part 50, Appendix G, and 10 CFR 50.61 rules and are consistent with the corresponding AMR items for these components in the GALL Report and SRP-LR.

GALL Report Table IV.A2 includes item IV.A2.RP-228 for evaluating loss of fracture toughness in PWR RVP inlet, outlet, and safety injection nozzles subject to neutron embrittlement TLAAs. The regulation in 10 CFR Part 50, Appendix H, establishes a neutron fluence of 1×10^{17} n/cm^2 (E > 1.0 MeV) as the threshold for determining when a ferritic RPV shell, nozzle, or weld component will need to be evaluated for changes in fracture toughness. Based on this criterion, GALL Report item IV.A2.RP-228 addresses loss of fracture toughness in PWR RPV inlet, outlet, and safety injection nozzles that may exceed this fluence threshold value at the end of the period of extended operation. These nozzles may need to be included within the scope of RPV components managed by AMPs corresponding to GALL Report AMP XI.M31, "Reactor Vessel Surveillance."

The staff noted that the LRA did not include an AMP-related AMR item for these reactor vessel nozzle components. However, during the AMP audit (July 25-28, 2016), the applicant provided the staff with onsite documentation which demonstrates the projected neutron fluence for these nozzles will be less than 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation. Therefore, based on this assessment, the staff concludes that the LRA does not need to include an AMR item such as GALL Report item IV.A2.RP-228 because the applicant has demonstrated that the neutron fluence projected for these nozzles at the expiration of the period of extended operation will be less than the threshold fluence value stated in 10 CFR Part 50, Appendix H (i.e., 1×10^{17} n/cm^2 for E > 1.0 MeV).

In its review of components associated with LRA item 3.1.1-14, 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 Reactor Vessel Surveillance program is acceptable because the basis is consistent with the guidelines in SRP-LR Section 3.1.2.2.3, item 2, and the AMR criteria in SRP-LR Table 3.1-1, item 14, and GALL Report item IV.A2.RP-229.

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 of ductile fracture toughness in PWR RVI components that are designed by B&W and are exposed to a reactor coolant and neutron flux environment. The criteria in SRP-LR Section 3.1.2.2.3, item 3, state that reduction in ductile fracture toughness may be evaluated in a plant-specific TLAA for PWR RVI components that were designed by B&W. The SRP-LR also states that these RVI components may need to be evaluated for the period of extended operation in accordance with the staff's SE that is included in B&W Technical Report No. BAW-2248-A, "Demonstration of the Management of Aging Effects for the Reactor Vessel Internals," dated March 2000. The applicant stated that this item is not applicable because the RVI components included in the WF3 plant design were fabricated by CE. The staff verified that the FSAR identifies that the RVI components at WF3 were designed by CE, and not by B&W. The staff finds the applicant's claim acceptable because the FSAR confirms that the RVI components at WF3 were designed by CE and the criteria in SRP-LR Section 3.1.2.2.3, item 3, are not applicable to the CLB for WF3.

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

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 (internal)

or reactor coolant. The applicant stated that this item is not applicable because it is applicable only to a BWR. The staff evaluated the applicant's claim and finds it acceptable because this item is applicable only to a BWR, as described in the SRP-LR Table 3.1.1, and the applicant's reactor is a PWR.

Item 2. LRA Section 3.1.2.2.4, item 2, associated with LRA Table 3.1.1, item 3.1.1-17, addresses cracking due to SSC or IGSCC in stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not applicable to the LRA because the applicable AMR items (i.e., item 17 in SRP-LR Table 3.1-1 and GALL Report item IV.C1.R-15) and AMR further evaluation guidance are only applicable to the design of isolation condensers in BWR-designed units.

The staff verified that the aging management guidelines only apply to BWR isolation condensers that may be included in the design of BWR-2 or BWR-3 model reactors and do not apply to PWR-designed reactor units. The staff also verified that the FSAR identifies the reactor facility at WF3 is a PWR designed by CE. Therefore, the staff evaluated the applicant's claim and finds it acceptable because the staff has confirmed that the guidelines in SRP-LR Section 3.1.2.2.4, item 2, and the AMR items in SRP-LR Table 3.1-1, item 17 and GALL Report item IV.C1.R-15 do not apply to the PWR design at WF3.

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 crack growth due to cyclic loading in the reactor vessel shell fabricated of SA-508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process exposed to reactor coolant. The criteria in SRP-LR Section 3.1.2.2.5 state that underclad cracks in the heat-affected zone under austenitic stainless steel cladding may need to be evaluated as a TLAA for the period of extended operation for all of the SA-508-Cl-2 forgings where the cladding was deposited with a high-heat input welding process. The applicant stated that this item is not applicable because the major portion of the reactor vessel material protected by cladding from exposure to reactor coolant is SA-533, Grade B, Class 1 plate, which is immune to underclad cracking. The LRA further states that cladding performed on SA-508, Class 2, forging material uses low-heat input welding processes controlled to minimize heating of the base metal.

The staff noted that FSAR Section 5.2.3.3.2.1 states that major RCS components were fabricated with corrosion resistant cladding on internal surfaces exposed to reactor coolant with consideration of RG 1.43. The staff reviewed FSAR Section 5.2.3.3.2.1 and confirmed that the majority portion of the reactor vessel component material protected by cladding is fabricated from SA-533, Grade B, Class 1, plate and that reactor vessel material protected by cladding fabricated from SA-508, Class 2, forging material was performed using low-heat input welding processes. The staff evaluated the applicant's claim and finds it acceptable because the applicant, consistent with the guidance in RG 1.43, has addressed potential underclad cracking through implementation of cladding fabrication processes immune to underclad cracking and welding processes that do not induce underclad cracking.

3.1.2.2.6 Cracking Due to Stress Corrosion Cracking

Item 1. LRA Section 3.1.2.2.6, item 1, associated with LRA Table 3.1.1, item 3.1.1-19, addresses the management of cracking in PWR reactor vessel flange leakoff line exposed to a reactor coolant environment. The LRA states that the WF3 reactor vessel has no bottom-mounted instrumentation guide tubes.

The criteria in SRP-LR Section 3.1.2.2.6, item 1, state that cracking due to an SCC mechanism could occur in a PWR RV flange leakoff line that is exposed to a reactor coolant environment. SRP-LR Section 3.1.2.2.6, item 1, also states that the GALL Report recommends further evaluation to ensure that this aging effect will be adequately managed and that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1.

In its review of the applicant's RV flange leak detection line, which is also associated with LRA Table 3.1.1, item 3.1.1-19, the staff noted that the RV flange leakoff line is made of stainless steel with a normal operating environment of air with borated water leakage. In addition, the applicant stated that SCC of the RV flange leakoff line will be managed by the One-Time Inspection program. As part of the One-Time Inspection program, the applicant has proposed using visual examinations to identify any cracking, if present. The staff finds the applicant's proposal to manage aging of the RV flange leakoff lines using the One-Time Inspection program acceptable because during normal operation, the environment for the applicant's RV flange leakoff lines will be air with borated water leakage. In addition, the applicant's RV flange leak detection line is fabricated from stainless steel. The staff noted that the GALL Report includes entries for stainless steels exposed to air with borated water leakage. These entries indicate that an AERM is not present for this material and environment combination. In an unlikely scenario when there is cracking, the visual examinations would identify any indication of borated water leakage, if present. Therefore, the staff finds that the applicant's proposal to use its One-Time Inspection program acceptable.

Based on the programs identified, the staff determines that the applicant's programs meet the criteria in SRP-LR Section 3.1.2.2.6, item 1. For the items associated with LRA Section 3.1.2.2.6, item 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 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 3.1.2.2.6, item 2, associated with LRA Table 3.1.1, item 3.1.1-20, addresses CASS Class 1 piping, piping components, and piping elements exposed to reactor coolant, which will be managed for cracking due to SCC by the Inservice Inspection program, Thermal Aging Embrittlement of CASS program, and the Water Chemistry Control – Primary and Secondary program. The criteria in SRP-LR Section 3.1.2.2.6, item 2, states that cracking due to SCC could occur for Class 1 PWR CASS RCS piping, piping components, and piping elements exposed to reactor coolant. The SRP-LR also states that an existing program should rely on control of water chemistry to mitigate SCC. However, the SRP-LR indicates that SCC could occur in CASS components that do not meet the NUREG–0313 guidelines with regard to ferrite and carbon content, and further evaluation of a plant-specific program is necessary for these components to ensure that this aging effect is adequately managed. The GALL Report recommends that this plant-specific program should include: (a) adequate inspection methods to ensure detection of cracks and (b) flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement to manage the effects of aging.

The applicant addressed the further evaluation criteria of the SRP-LR by stating that it will minimize contaminants which promote SCC using the Water Chemistry Control – Primary and Secondary program and that the Inservice Inspection program provides qualified inspection techniques to monitor cracking. The LRA further states that the Thermal Aging Embrittlement of CASS program will identify the components susceptible to thermal aging embrittlement and

provide aging management through either enhanced visual examinations or component-specific flaw tolerance evaluations.

In its review of components associated with item 3.1.1-20, the staff noted that the applicant did not provide its methodology that will be used to identify Class 1 CASS RCS piping, piping components, and piping elements that do not meet the NUREG–0313 guidelines for ferrite and carbon content. In addition, the applicant did not provide sufficient information about the "qualified inspection techniques" within the Inservice Inspection program that will monitor cracking. By letter dated November 7, 2016, the staff issued RAI 3.1.2.2.6.2-1, requesting additional information to address these concerns.

In its response, by letter dated December 7, 2016, the applicant stated that it will review the CMTRs of potentially susceptible in-scope CASS components to determine if they meet the NUREG–0313 guidelines for ferrite and carbon content. The staff finds this acceptable because reviewing the CMTRs of the components will provide the necessary information to determine if the components meet the NUREG–0313 guidelines. In its response regarding qualified examination methods, the applicant stated that there is currently no enhanced visual examination nor any other inspection technique that is qualified by ASME or EPRI to detect cracking due to SCC in ASME Class 1 CASS piping components. The applicant stated that it will work with ASME and EPRI to identify a viable inspection method for detecting such cracks and will implement these inspections under the Inservice Inspection program as supplemental inspections. The applicant further stated that these inspections will: (a) be performed on a sampling basis; (b) determine the extent and frequency based on the established method of inspection and industry operating experience and practices when the program is implemented; and (c) include components deemed limiting from a standpoint of applied stress, operating time, and environmental considerations. The applicant also amended LRA Section 3.1.2.2.6 to state: "[f]or CASS components that do not meet the NUREG–0313 guidelines with regard to ferrite and carbon content, inspection techniques qualified by ASME or EPRI will be used as part of the Inservice Inspection program to manage cracking." The applicant also added an enhancement to its Inservice Inspection program to revise the program to include these inspections.

In its review, the staff finds the applicant's response acceptable because: (a) the applicant clarified that the CMTRs will be used to determine if Class 1 piping and piping components do not meet the NUREG–0313 guidelines and (b) the applicant identified an enhancement for the Inservice Inspection program to include an ASME- or EPRI-qualified inspection technique, which will adequately detect cracks, prior to entering the period of extended operation. The staff's concerns in RAI 3.1.2.2.6-1 are resolved.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program, Inservice Inspection program, and Thermal Aging Embrittlement of CASS program are documented in SER Sections 3.0.3.1.19, 3.0.3.1.5, and 3.0.3.1.18, respectively.

The staff finds that the applicant has met the further evaluation criteria, and the applicant's proposal to manage the effects of aging is acceptable because: (a) the Water Chemistry Control – Primary and Secondary program will monitor and control the primary water chemistry to minimize the potential for SCC consistent with the GALL Report; (b) the Inservice Inspection program, when enhanced, will provide adequate inspection methods to ensure detection of cracking due to SCC; and (c) the Thermal Aging Embrittlement of CASS program will identify and provide flaw evaluation methodology for CASS components that are susceptible to thermal aging embrittlement and manage the effects of aging.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.1.2.2.6, item 2, criteria. For those items associated with LRA Section 3.1.2.2.6, item 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).

3.1.2.2.7 Cracking Due to Cyclic Loading

LRA Section 3.1.2.2.7, associated with LRA Table 3.1.1, item 3.1.1-21, addresses cracking due to cyclic loading in steel or stainless steel BWR isolation condenser components exposed to reactor coolant. The applicant stated that this item is not applicable to the LRA because the applicable AMR items (i.e., item 21 in SRP-LR Table 3.1-1 and GALL Report item IV.C1.R-225) and AMR further evaluation guidance are only applicable to the design of isolation condensers in BWR-designed units.

The staff verified that the aging management guidelines only apply to BWR isolation condensers that may be included in the design of BWR-2 or BWR-3 model reactors, and do not apply to PWR-designed reactor units. The staff also verified that the FSAR identifies the reactor facility at WF3 is a PWR designed by CE. Therefore, the staff evaluated the applicant's claim and finds it acceptable because the staff has confirmed that the guidelines in SRP-LR Section 3.1.2.2.7 and the items in SRP-LR Table 3.1-1, item 21 and GALL Report IV.C1.R-225 do not apply to the PWR design at WF3.

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 that could occur in steel SG feedwater impingement plates and supports exposed to secondary feedwater. The acceptance criteria for this aging management are described in SRP-LR Section 3.1.2.2.8. In the LRA, the applicant indicated that this item is not applicable because the SGs do not have feedwater impingement plates. The staff evaluated the applicant's claim and finds it acceptable because the applicant confirmed that the SGs do not have feedwater impingement plates.

3.1.2.2.9 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

The LRA states that the paragraph (FE Section 3.1.2.2.9) was removed from the SRP-LR as a result of LR-ISG-2011-04. The staff confirmed that LR-ISG-2011-04, issued May 28, 2013, removed this item and that it is not applicable.

3.1.2.2.10 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement, Change in Dimension Due to Void Swelling, Loss of Preload Due to Stress Relaxation, or Loss of Material Due to Wear

The LRA states that the paragraph (FE Section 3.1.2.2.10) was removed from the SRP-LR as a result of LR-ISG-2011-04. The staff confirmed that LR-ISG-2011-04, issued May 28, 2013, removed this item and that it is not applicable.

3.1.2.2.11 Cracking Due to Primary Water Stress Corrosion Cracking

Item 1: LRA Section 3.1.2.2.11, item 1, associated with LRA Table 3.1.1 item 3.1.1-25, addresses nickel alloy SG divider plate assemblies exposed to reactor coolant. As addressed in SER Section 3.0.3.1.17, the applicant's letter dated December 7, 2016 (response to RAI B.1.37-1), indicates that cracking due to PWSCC in these components is managed by using the Water Chemistry Control – Primary and Secondary program.

The criteria in SRP-LR Section 3.1.2.2.11, item 1, as revised in LR-ISG-2016-01, state that PWSCC could occur in SG divider plate assemblies exposed to reactor coolant. The SRP-LR, as revised, also indicates that for units with divider plate assemblies fabricated of Alloy 690 and Alloy 690 type weld materials, a plant-specific AMP is not necessary because these materials are resistant to PWSCC. The applicant addressed the further evaluation criteria of the SRP-LR by indicating that all of the locations of the divider plate assemblies in contact with primary coolant are fabricated of Alloy 690 type materials, which are resistant to PWSCC. In its review, the staff finds that the applicant's evaluation (i.e., no need for a plant-specific program based on the use of resistant materials) is consistent with the guidance in SRP-LR Section 3.1.2.2.11.

As also addressed in SER Section 3.0.3.1.17, the applicant's letter dated March 16, 2017, indicates that the Steam Generator Integrity program includes visual inspections of channel head internal areas to detect rust stains, discoloration, or distortion of the cladding. Although the applicant indicated that these visual inspections are not intended to directly detect PWSCC, the staff noted that these inspections are sufficient to reveal degradation of channel head base materials (such as loss of material) associated with PWSCC of divider plates and its propagation into the channel head base material. In its review, the staff finds that these existing inspections can reveal potential degradation of RCPB components and, therefore, are acceptable.

The staff's evaluation of the applicant's Water Chemistry Control – Primary and Secondary program is documented in SER Section 3.0.3.1.19. The staff noted that the applicant's SG divider plate assemblies exposed to reactor coolant are made of Alloy 690 type materials, which are resistant to PWSCC. In its review of components associated with item 3.1.1-25, 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 Water Chemistry Control – Primary and Secondary program acceptable because (1) the divider plate assemblies exposed to reactor coolant are fabricated with Alloy 690 type materials, which are resistant to PWSCC; (2) the Water Chemistry Control – Primary and Secondary program limits the concentrations of chemical species known to cause SCC within the acceptable ranges to minimize the environmental effect on SCC; and (3) the applicant performs visual inspections to detect rust stains, discoloration, or distortion of the cladding on SG channel head internal areas, which can reveal evidence of cracking.

Item 2: LRA Section 3.1.2.2.11, item 2, associated with LRA Table 3.1.1, item 3.1.1-25, addresses nickel alloy SG tube-to-tubesheet welds exposed to reactor coolant that will be managed for cracking due to PWSCC by the Water Chemistry Control – Primary and Secondary program.

The criteria in SRP-LR Section 3.1.2.2.11, item 2, state that PWSCC could occur in SG tube-to-tubesheet welds exposed to reactor coolant. The SRP-LR also indicates that, for plants with Alloy 690 SG tubes with Alloy 690 type tubesheet cladding, the Water Chemistry Control – Primary and Secondary program is sufficient, and no further action or plant-specific AMP is required. The applicant addressed the further evaluation criteria of the SRP-LR by stating that

the tubes and tubesheet cladding are made of Alloy 690 type materials, which are resistant to PWSCC.

As discussed above, the Steam Generator Integrity program includes visual inspections of channel head internal areas to detect rust stains, discoloration, or distortion of the cladding. Although the applicant indicated that these visual inspections are not intended to directly detect PWSCC, the staff noted that these visual inspections are sufficient to reveal degradation of tubesheet base materials (such as loss of material) associated with PWSCC of tube-to-tubesheet welds and its propagation into tubesheet base materials. In its review, the staff finds that these existing inspections can reveal potential degradation of RCPB components and, therefore, are acceptable.

The staff's evaluation of the applicant's Water Chemistry Control – Primary and Secondary program is documented in SER Section 3.0.3.1.19. The staff noted that the applicant's SG tube-to-tubesheet welds are made of Alloy 690 type materials, which are resistant to PWSCC. In its review of components associated with item 3.1.1-25, 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 Water Chemistry Control – Primary and Secondary program acceptable because (1) the tube-to-tubesheet welds are fabricated with Alloy 690 type materials, which are resistant to PWSCC; (2) the Water Chemistry Control – Primary and Secondary program limits the concentrations of chemical species known to cause SCC within the acceptable ranges to minimize the environmental effect on SCC; and (3) the applicant performs visual inspections to detect rust stains, discoloration, or distortion of the cladding on channel head internal areas, which can reveal evidence of cracking.

Based on the program identified, the staff determines that the applicant's program meets SRP-LR Section 3.1.2.2.11, item 1 and 2, criteria. For those items associated with LRA Section 3.1.2.2.11, 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.1.2-4 (as updated in response to RAI 3.1.1.88-1a by letter dated March 16, 2017), the applicant addressed AMR items for carbon steel clad with nickel alloy (Alloy 690) tubesheets and channel heads exposed to treated borated water. The applicant indicated that these components will be managed for loss of material by the Steam Generator Integrity program and Water Chemistry Control – Primary and Secondary program. The AMR items cite generic note H. The AMR items also cite plant-specific note 106, which states that the Steam Generator Integrity program, in conjunction with the Water Chemistry Control – Primary and Secondary program, will manage loss of material due to boric acid corrosion for the SG channel head and tubesheet.

The staff noted that this material and environment combination is identified in the GALL Report, as revised in LR-ISG-2016-01, which states that steel (with stainless steel or nickel alloy cladding) SG channel heads and tubesheets exposed to reactor coolant are susceptible to loss of material due to boric acid corrosion. The revised guidance also recommends GALL Report AMP XI.M2, "Water Chemistry," and AMP XI.M19, "Steam Generators," which include periodic visual inspections, to manage the aging effect.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program and Steam Generator Integrity program are documented in SER Sections 3.0.3.1.19 and 3.0.3.1.15, respectively. The staff finds the applicant's proposal to manage loss of material

in carbon steel clad with nickel alloy (Alloy 690) tubesheets and channel heads using the Water Chemistry Control – Primary and Secondary program and Steam Generator Integrity program acceptable because (1) the tubesheet and channel head are clad with Alloy 690, which is resistant to PWSCC; (2) the Water Chemistry Control – Primary and Secondary program limits the concentrations of chemical species (e.g., oxygen) known to cause loss of material; and (3) the applicant performs periodic visual inspections to detect anomalous conditions (e.g., rust stains) that may be indicative of the aging effect.

3.1.2.2.12 Cracking Due to Fatigue

The LRA states that the paragraph (FE Section 3.1.2.2.12) was removed from the SRP-LR as a result of LR-ISG-2011-04. The staff confirmed that LR-ISG-2011-04, issued May 28, 2013, removed this item and that it is not applicable.

3.1.2.2.13 Cracking Due to Stress Corrosion Cracking and Fatigue

The LRA states that the paragraph (FE Section 3.1.2.2.13) was removed from the SRP-LR as a result of LR-ISG-2011-04. The staff confirmed that LR-ISG-2011-04, issued May 28, 2013, removed this item and that it is not applicable.

3.1.2.2.14 Loss of Material Due to Wear

The LRA states that the paragraph (FE Section 3.1.2.2.14) was removed from the SRP-LR as a result of LR-ISG-2011-04. The staff confirmed that LR-ISG-2011-04, issued May 28, 2013, removed this item and that it is not applicable.

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 3.1.2-5-2, 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 3.1.2-5-2, 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 Vessel – 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 Vessel component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for the Reactor Vessel component groups are consistent with the GALL Report.

3.1.2.3.2 Reactor Vessel Internals – 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 internals component groups.

Zircaloy Incore Instrumentation (Thimble – lower part) Exposed to Treated Borated Water > 140 °C and Neutron Fluence. In LRA Table 3.1.2-2, the applicant stated that zircaloy ICI (thimble – lower part) exposed to treated borated water > 140 °C and neutron fluence will be managed for changes in dimension by the Reactor Vessel Internals program (LRA AMP B.1.33). The AMR item cites generic note H. The applicant's AMP corresponds to the AMP given in GALL Report AMP XI.M16A, "PWR Vessel Internals."

The staff noted that, for this material and environment combination, the GALL Report identifies that loss of material due to wear is the applicable aging effect and mechanism for the ICI thimble tubes and that GALL Report AMP XI.M16A, "PWR Vessel Internals," be used as one method for managing the aging effect. However the applicant stated that the GALL Report-identified aging effect (i.e., loss of material due to wear) for this component, material, and environment combination is not applicable to the design of the ICI thimble tubes at WF3. During the second LRA AMP audit (July 25–28, 2016), the staff determined that the applicant had provided an adequate basis for concluding that loss of material due to wear is not an aging effect for the ICI thimble tubes because the applicant had replaced the thimble tubes with tube materials (i.e., chromium alloy stainless steel plated zircaloy tubes) that are more resistant to wear.

However, the staff noted that the applicant identifies changes in dimension due to irradiation growth as an applicable AERM for the replaced thimble tubes in the plant design. The staff verified that the applicant appropriately evaluated this aging effect as part of its basis for resolving A/LAI No. 2 on the methodology for managing PWR RVI components, which is given in EPRI TR No. 1022863 (i.e., EPRI TR MRP-227-A (ADAMS Accession Nos. ML12017A193, ML12017A194, ML12017A196, ML12017A197, ML12017A191, ML12017A192, ML12017A195 and ML12017A199)). The MRP-227-A report was approved in an SE issued by the staff on December 16, 2011 (ADAMS Accession No. ML11308A770).

The staff also verified that the applicant adjusted its AMP to include physical measurements of the ICI thimble tubes to monitor for and manage any changes in dimension that may be occurring in the components during the period of extended operation. The staff determined that this is consistent with other bases in the MRP-227-A report for managing changes in dimension induced by irradiation growth (i.e., void swelling) or distortion. Therefore, the staff finds the AMR basis for aging management to be acceptable because: (a) the proposed AMP corresponds to the recommended program in the GALL Report for managing aging effects in PWR RVI components, and (b) the applicant's basis for managing changes in dimension is consistent with those identified for this aging effect in the MRP-227-A report.

The staff's evaluation of the applicant's Reactor Vessel Internals program is documented in SER Section 3.0.3.2.18. The evaluation in SER Section 3.0.3.2.18 includes the staff's assessment of the applicant's basis for performing physical measurement examinations of the ICI thimble tubes to monitor for and manage any potential changes in dimension that may be occurring in the components during the period of extended operation.

3.1.2.3.3 Reactor Coolant Pressure Boundary – 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 RCPB component groups.

Stainless Steel Piping Exposed to Treated Borated Water. In LRA Table 3.1.2-3, the applicant stated that RV flange leakoff line made of stainless steel exposed to treated borated water will be managed for loss of material by the One-Time Inspection program. The AMR items cite generic note H.

The staff's evaluation of the applicant's One-Time Inspection program is documented in SER Section 3.0.3.1.13. The staff noted that the GALL Report includes entries for stainless steels exposed to air with borated water leakage. These entries indicate that an AERM is not present for this material and environment combination. In an unlikely scenario where loss of material is noted, the program includes acceptance criteria for loss of material and corrective actions to ensure leakage integrity of the reactor head flange leakoff line. The staff finds the applicant's proposal to manage the effects of aging using the One-Time Inspection program acceptable because visual inspections by qualified personnel are capable of detecting loss of material.

3.1.2.3.4 Steam Generators – Summary of Aging Management Review – LRA Table 3.1.2-4

The staff reviewed LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the steam generator component groups.

Carbon Steel (Clad with Nickel Alloy) Steam Generator Tubesheets and Channel Heads Exposed to Treated Borated Water (Internal). LRA Table 3.1.2-4, as supplemented by letter dated March 16, 2017, addresses loss of material due to boric acid corrosion in the carbon steel (clad with nickel alloy) SG tubesheets and channel heads, which are exposed to treated borated water (internal). The AMR items cite generic note H and plant-specific note 106, in which the applicant proposed to use the Steam Generator Integrity program and Water Chemistry Control – Primary and Secondary program to manage loss of material for these components.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program and Steam Generator Integrity program are documented in SER Sections 3.0.3.1.19

and 3.0.3.1.17, respectively. The applicant's Water Chemistry Control – Primary and Secondary program performs periodic monitoring and control of water chemistry. The applicant's Steam Generator Integrity program includes visual inspections of the steam generator channel head internal surfaces to identify degradation such as corrosion.

The staff finds the applicant's proposal to manage loss of material using the Water Chemistry Control – Primary and Secondary program and Steam Generator Integrity program acceptable because the applicant's programs include visual inspections to detect and monitor loss of material in these components and water chemistry control to minimize the environmental effects on the loss of material aging effect (in case the carbon steel base material is exposed to reactor coolant due to potential cracking in the cladding). The staff also finds that the applicant's aging management review result is consistent with the guidance in LR-ISG-2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components."

Carbon Steel Steam Generator Components Exposed to Indoor Air (External). In LRA Table 3.1.2-4, the applicant stated that for carbon steel SG pressure boundary and structural components externally exposed to air-indoor, there is no aging effect and no AMP is proposed. The AMR items cite generic note G and plant-specific note 105, which state that the high component surface temperature precludes moisture accumulation that could result in corrosion.

The staff reviewed the associated items in the LRA to confirm that aging effects are not applicable for this component, material, and environment combination. The staff noted that the air-indoor environment in LRA Table 3.0-1 is not necessarily controlled and may have water, steam, borated water, or reactor coolant leakage. The GALL Report states that carbon steel components in an air-indoor uncontrolled environment may be subject to loss of material due to corrosion and recommends that AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," be used to manage this aging effect.

By letter dated November 7, 2016, the staff issued RAI 3.1.2-1 requesting that the applicant justify why loss of material due to corrosion is not an applicable aging effect for the SG components because moisture accumulation could occur during normal plant events, such as refueling outages. In its response dated December 7, 2016, the applicant stated that indoor ambient temperatures are maintained above the dew point during outages, and component temperatures below the dew point occur only briefly, if at all, during shutdown operations. The applicant further stated that operating experience supports the conclusion; the original SGs, replaced in 2012, showed no significant corrosion after 30 years of operation.

The staff finds both the applicant's response to RAI 3.1.2-1 and its proposal regarding no AERM acceptable, because indoor air temperatures are maintained above dew points, which limits moisture accumulation on the exterior surfaces of the SG components. In addition, the applicant's plant-specific operating experience demonstrates that these components have not experienced significant loss of material due to corrosion after 30 years. The staff's concerns described in RAI 3.1.2-1 are resolved.

Nickel Alloy Steam Generator Tubes Exposed to Treated Borated Water (Internal). In LRA Table 3.1.2-4, the applicant stated that, for nickel alloy (Alloy 690) SG tubes exposed to treated borated water (internal), there is no aging effect that can affect the heat transfer function of the tube internal surface and, therefore, no AMP is proposed. The AMR item cites generic note H. The staff reviewed the associated items in the LRA to confirm that there is no aging effect affecting the heat transfer function of the tube internal side (reactor coolant side). In its review, the staff finds that the applicant's aging management review result is acceptable because, in

contrast with the secondary side of the steam generator, the internal surfaces of SG tubes are not subject to fouling that can cause reduction in heat transfer.

Nickel Alloy Tubes Externally Exposed to Treated Water. In LRA Table 3.1.2-4, the applicant stated that nickel alloy tubes externally exposed to treated water will be managed for reduction of heat transfer by the Water Chemistry Control – Primary and Secondary 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 nickel alloy tubes exposed to secondary feedwater or steam are susceptible to loss of material and cracking and recommends GALL Report AMP XI.M19, "Steam Generators," and/or GALL Report AMP XI.M2, "Water Chemistry," to manage the 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 3.1.2-4. However, the applicant has identified loss of heat transfer as an additional aging effect.

The staff's evaluation of the applicant's Water Chemistry Control – Primary and Secondary program is documented in SER Section 3.0.3.1.19. The applicant's Water Chemistry Control – Primary and Secondary 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 staff finds the applicant's proposal to manage reduction of heat transfer using the Water Chemistry Control – Primary and Secondary program acceptable because maintaining proper secondary water chemistry will minimize the amount of sludge and other deposits that can contribute to a reduction in heat transfer.

3.1.2.3.5 RCS Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Review – LRA Tables 3.1.2-5-1 and 3.1.2-5-2

The staff reviewed LRA Tables 3.1.2-5-1 and 3.1.2-5-2, which summarize the results of AMR evaluations for the RCS and SGs nonsafety-related components affecting safety-related systems component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for these component groups are consistent with the GALL Report.

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the reactor vessel, internals, and 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 ESF systems components of the following:

- Containment Spray
- Safety Injection

- Containment Penetrations
- ESF Systems in Scope for 10 CFR 54.4(a)(2)

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 Programs for Engineered Safety Features Evaluated in Chapter V of NUREG–1801,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the ESF 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 CRs 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 WF3 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 to WF3	Not Applicable (see SER Section 3.2.2.2.2
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 to WF3	Not Applicable (see SER Section 3.2.2.2.3, item 1)
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	Not Applicable to WF3	Not Applicable (see SER Section 3.2.2.2.3, item 2)
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 to WF3	Not Applicable (see SER Section 3.2.2.2.4)

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
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 (BWR Only)	Not Applicable (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	Not Applicable to WF3	Not Applicable (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 to WF3	Not Applicable
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	Boric Acid Corrosion	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable
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

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) (3.2.1-13)	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 used	Not used (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
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Not used (see SER Section 3.2.2.1.1)
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	Not Applicable (BWR Only)	Not Applicable
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Not used (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	Water Chemistry Control – Primary and Secondary 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
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 (BWR Only)	Not Applicable to WF3

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 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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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	Not Applicable to WF3	Not Applicable to WF3
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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3

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 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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable
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 used	Not used (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	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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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) (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 (BWR Only)	Not Applicable
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	Internal Surfaces in Miscellaneous Piping and Ducting Components, Periodic Surveillance and Preventive Maintenance, and External Surfaces Monitoring	Consistent with the GALL Report (see SER section 3.2.2.1.2)
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 to WF3	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable
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 to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3
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	Oil Analysis 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
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	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	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 to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3
Steel, stainless steel, nickel alloy underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external) (3.2.1-53.5)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not Applicable to WF3	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable

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 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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable
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 to WF3	Not Applicable to WF3 (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	Consistent with NUREG–1801 (the GALL Report)	Consistent with the GALL Report
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 (the GALL Report)	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 to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3 (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
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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	External Surfaces Monitoring	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3

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	External Surfaces Monitoring	Consistent with the GALL Report
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	Coating Integrity	Consistent with the GALL Report
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	Coating Integrity	Consistent with the GALL Report
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 Applicable to WF3	Not Applicable to WF3

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
- Boric Acid Corrosion
- Coating Integrity
- External Surfaces Monitoring
- Oil Analysis

- One-Time Inspection
- Water Chemistry Control – Closed Treated Water Systems
- Water Chemistry Control – Primary and Secondary

LRA Tables 3.2.2-1 through 3.2.2-4-2 summarize the AMR results 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 3.2.1-6, 3.2.1-11, 3.2.1-17, 3.2.1-26, 3.2.1-38, 3.2.1-43, 3.2.1-46, and 3.2.1-54, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR; confirmed that these items only apply to BWRs; and finds that these items are not applicable to WF3, which is a CE plant-designed PWR.

For LRA Table 3.2.1, items 3.2.1-2 through 3.2.1-5, 3.2.1-7, 3.2.1-8, 3.2.1-10, 3.2.1-21, 3.2.1-23 through 3.2.1-25, 3.2.1-27 through 3.2.1-29, 3.2.1-32, 3.2.1-34 through 3.2.1-37, 3.2.1-41, 3.2.1-42, 3.2.1-45, 3.2.1-47, 3.2.1-48, 3.2.1-52, 3.2.1-53, 3.2.1-53.5, 3.2.1-55, 3.2.1-58, 3.2.1-64, 3.2.1-65, 3.2.1-67, 3.2.1-68, 3.2.1-70, and 3.2.1-74, 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 WF3. The staff reviewed the LRA and FSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

For LRA Table 3.2.1, items 3.2.1-14, 3.2.1-16, 3.2.1-18, and 3.2.1-39, the applicant claimed that the corresponding items the GALL Report are not used because the component, material, and environment combinations are addressed under alternative AMR items. The staff evaluated the applicant's claim and finds it acceptable because the alternative AMR items are appropriate for the component, material, and environment combinations. The adequacy of the alternative items to manage the effects of aging for these AMR items was evaluated within their respective systems and component groups.

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 it did not use item 3.2.1-14 because: (1) this component group is assigned to LRA Table 3.2.1, item 3.2.1-13, which addresses, under the Bolting Integrity AMP, loss of material of steel bolting exposed to an air environment; and (2) the applicant did not consider steam or water leakage to be a separate aspect of the air indoor environment. The staff reviewed LRA Section 3.2 and confirmed that the applicant used item 3.2.1-13 for the component group associated with item 3.2.1-14. The staff evaluated the applicant's claim and finds it acceptable because the applicant evaluated and addressed the AERMs for steel closure bolting exposed to air with steam or water leakage with LRA Table 3.2.1, item 3.2.1-13, which manages loss of material under the Bolting Integrity program, and this is consistent with the GALL Report.

LRA Table 3.2.1, item 3.2.1-16, addresses steel containment isolation piping and components, piping, piping components, and piping elements exposed internally to treated water. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and GALL Report AMP XI.M32, "One-Time Inspection" to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this item is not applicable

because the steel containment isolation components were evaluated as part of their respective systems. The staff evaluated the applicant's claim and finds it acceptable because the piping, piping components, and piping elements exposed to treated water are being evaluated in other items in their respective systems.

LRA Table 3.2.1, item 3.2.1-18, addresses stainless steel containment isolation piping and components exposed internally to treated water. The GALL Report recommends GALL Report AMP XI.M2, "Water Chemistry," and GALL Report AMP XI.M32, "One-Time Inspection" to manage loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this item is not applicable because the stainless steel containment isolation components were evaluated as part of their respective systems. The staff evaluated the applicant's claim and finds it acceptable because the piping, piping components, and piping elements exposed to treated water are being evaluated in other items in their respective systems.

LRA Table 3.2.1, item 3.2.1-65, addresses components made from any material exposed to treated water or treated borated water: The GALL Report recommends GALL Report AMP XI.M17, "Flow-Accelerated Corrosion," to manage loss of material due to erosion for this component group. The applicant stated that the materials, environments, and operating conditions of ESF system components are not conducive to erosion and did not use this AMR item. The staff notes that, as discussed in the Audit Report, the staff conducted an independent search of plant operating experience information using keywords associated with various erosion mechanisms. Based on its review, the staff finds the applicant's claim acceptable because it did not identify degradation due to erosion mechanisms in ESF components during its independent search of the plant operating experience information.

For the LRA Table 3.2.1 item discussed below, the applicant claimed that the corresponding AMR item in the GALL Report is not applicable. For this item, the staff reviewed sources beyond the LRA and FSAR or issued one or more RAIs, or both, to verify the applicant's claim of non-applicability.

LRA Table 3.2.1, item 3.2.1-59, addresses galvanized steel ducting, piping, and components externally exposed to controlled indoor air and states that the item is not applicable because galvanized steel is evaluated as steel. SRP-LR item 3.2.1-59 recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment. The staff noted that LRA Table 3.2.1 contains AMR items for (ungalvanized) steel and, therefore, the staff finds the applicant's claim acceptable.

3.2.2.1.2 Loss of Material Due to General Corrosion

LRA Table 3.2.1, item 3.2.1-44, addresses carbon steel piping, ducting, and components internally exposed to uncontrolled indoor air, which will be managed for loss of material due to general corrosion. For the AMR items that cite generic note E, the LRA credits either the External Surfaces Monitoring program or Periodic Surveillance and Preventive Maintenance program to manage the aging effect for steel piping and piping components. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.M38 recommends using opportunistic visual inspections, with a representative sample of components inspected at least once every 10 years, to manage the effects of aging. GALL Report AMP XI.M38 also states that when the material and environment combinations are similar for the internal and external surfaces,

external inspections of components may be credited for managing loss of material on the internal surfaces of metallic components.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The External Surfaces Monitoring program proposes to manage the effects of aging for carbon steel piping and piping components through the use of periodic visual inspections at least once per refueling outage. The External Surfaces Monitoring program also states that the program is used to manage loss of material on the internal surfaces of carbon steel components when the internal and external surfaces are exposed to the same environment, which is consistent with the GALL Report guidance. Based on its review of components associated with item 3.2.1-44, for which the applicant cited generic note E, and the use of the External Surfaces Monitoring program, the staff finds the applicant's proposal to manage the effects of aging using this program acceptable because periodic visual inspections of component external surfaces at least once per refueling outage are sufficient to identify the potential for corrosion of component internal surfaces when internal and external environments are the same.

The staff's evaluation of the applicant's Periodic Surveillance and Preventive Maintenance program is documented in SER Section 3.0.3.3.1. The program proposes to manage the effects of aging for the pump casing internal surfaces in the component cooling and ACCW system, the fan housing internal surfaces in the control room HVAC system, and piping internal surfaces in the secondary sampling system through the use of periodic visual inspections with a frequency of at least once every 5 years. Based on its review of components associated with item 3.2.1-44, for which the applicant cited generic note E, and the use of the Periodic Surveillance and Preventive Maintenance program, the staff finds the applicant's proposal to manage the effects of aging using this program acceptable because visual inspections at a frequency of at least once every 5 years is more conservative than the inspection approach recommended by the GALL Report and is capable of identifying loss of material prior to loss of component intended functions.

The staff concludes that for LRA item 3.2.1-44, 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, associated with LRA Table 3.2.1, item 3.2.1-1, states that the effects of cumulative fatigue damage due to fatigue of stainless steel, steel piping, piping components, and piping elements exposed to treated water (borated) will be evaluated as a TLAA. The LRA further states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of these TLAAs are addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.2.2.2.1 and is, therefore, acceptable. The staff's evaluation of these TLAAs for cumulative fatigue damage are 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 steel with stainless steel cladding pump casings exposed to treated borated water. The applicant stated that the safety injection system pump casings are solid stainless steel. The staff confirmed the applicant's statement by reviewing the FSAR and finds that this item would not apply because the pump casings are not steel with stainless steel cladding, and the solid stainless steel pump casings are not susceptible to boric acid corrosion.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Item 1. LRA Section 3.2.2.2.3, item 1, associated with LRA Table 3.2.1, item 3.2.1-3, addresses partially encased stainless steel tanks exposed to raw water. The criteria in SRP-LR Section 3.2.2.2.3, item 1, states that moisture and water can enter under the tank if the perimeter seal is degraded. The applicant stated that this item is not applicable 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 LRA and FSAR reviews, 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 states that loss of material could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and in which condensation or deliquescence is possible. The applicant stated that this item is not applicable because there are no stainless steel components exposed to outdoor air in the ESF systems within the scope of license renewal. The staff evaluated the applicant's claim and finds it acceptable because the staff reviewed the LRA and FSAR and verified that there are no in-scope stainless steel components exposed to outdoor air in the ESF systems.

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 loss of material due to erosion in stainless steel high-pressure safety injection pump minimum flow recirculation orifices exposed to treated borated water. The criteria in SRP-LR Section 3.2.2.2.4 recommends that a plant-specific AMP be evaluated for erosion of the orifice due to extended use of the centrifugal high-pressure safety injection pump for normal charging. The SRP-LR cites LER 50-275/94-023 as the basis for this issue. The applicant addressed this item by stating that the high-pressure safety injection pumps are not used for normal charging and consequently did not use the associated AMR item.

In its evaluation of the applicant’s statement, the staff notes that the cited LER ascribes the root cause of the orifice erosion to be the use of the centrifugal charging pumps for normal charging for up to 5 years of operation. The LER also describes the corrective actions to prevent recurrence as returning the positive displacement pumps as the primary supply for normal charging instead of the centrifugal charging pumps. The staff finds the applicant’s approach acceptable because not using the high-pressure safety injection pumps for normal charging removes the cause of the loss of material by reducing the minimum flow orifice erosion and eliminates the need for a plant-specific AMP.

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 for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to indoor air. The applicant stated that this item is not applicable because it is only applicable to BWRs. The staff evaluated the applicant’s claim and finds it acceptable because the staff reviewed SRP-LR Section 3.2.2.2.5 and SRP-LR Table 3.2.1, item 6, and verified that this item is not applicable because it is only applicable to BWRs.

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 states that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and in which condensation or deliquescence is possible. The applicant stated that this item is not applicable because there are no stainless steel components exposed to outdoor air in the ESF systems within the scope of license renewal. The staff evaluated the applicant’s claim and finds it acceptable because the staff reviewed the LRA and FSAR and verified that there are no in-scope stainless steel components exposed to outdoor air in the ESF systems.

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 AMP operating experience.

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 metallic piping, piping components, and tanks exposed to raw water or waste water. As modified by LR-ISG-2012-02, the criteria in SRP-LR Section 3.2.2.2.9 state that recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. The SRP-LR also states that recurring internal corrosion can be identified by searching plant operating experience for repeated instances where an aging effect results in a components either not meeting plant-specific criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant stated that it did not identify any conditions of recurring internal corrosion in the ESF systems within the scope of license renewal during its review of 10 years of plant operating experience. The staff evaluated the applicant's claim and finds it acceptable because the staff's independent review of plant operating experience during its onsite audit of the applicant's AMPs did not identify conditions in the ESF systems that met the further evaluation criteria in the SRP-LR that could result in the need to augment the AMPs.

3.2.2.3 Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-4-2, 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 3.2.2-4-2, 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 Containment Spray – Summary of Aging Management Evaluation – LRA Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, 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 all of the listed combinations of component type, material, environment, and AERM for the combustible gas control system component groups are consistent with the GALL Report.

3.2.2.3.2 Safety Injection – 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 safety injection component groups.

Nickel Alloy Thermowell Internally Exposed to Treated Borated Water. In LRA Table 3.2.2-2, the applicant stated that nickel alloy thermowell internally exposed to treated borated water will be managed for loss of material by the Water Chemistry Control – Primary and Secondary program. The AMR item cites 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. The staff reviewed "ASM Specialty Handbook - Nickel, Cobalt, and Their Alloys," which states nickel alloys, such as Alloy 600, are "highly resistant to general corrosion and SCC 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 3.0.3.1, the staff found that the applicant monitors the water chemistry in accordance with EPRI Report 1014986, "PWR Primary Water Chemistry Guidelines," Revision 6. These guidelines include the monitoring of chlorides, fluorides, sulfates, and sodium. During the audit, the staff verified that the applicant monitors these parameters in accordance with the recommendations of the guidelines. 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. Additionally, the GALL Report recommends a verification of the effectiveness of the chemistry control program, such as by including the program in GALL Report AMP XI.M32, "One-Time Inspection," program to verify that significant degradation is not occurring. Based on the information contained in the LRA and reviewed by the staff during the audit, the staff could not determine if the nickel alloy thermowell will be subjected to a one-time inspection. By letter dated November 7, 2016, the staff issued RAI 3.2.2.2-1 requesting that the applicant confirm that a One-Time Inspection program, such as GALL Report AMP XI.M32, will be used to verify the effectiveness of the Water Chemistry Control – Primary and Secondary program for managing loss of material for nickel alloy thermowell or provide the bases for not requiring this verification.

In its response dated December 7, 2016, the applicant stated that the One-Time Inspection program will verify the effectiveness of the Water Chemistry Control – Primary and Secondary program for managing loss of material. The description of the One-Time Inspection program includes the aging effect of loss of material for the Water Chemistry Control – Primary and Secondary program. However, the staff noted that the applicant's response was incomplete because it was not clear if the sample population for the One-Time Inspection program will include loss of material for nickel alloy thermowell. By letter dated January 9, 2017, the applicant revised the RAI response and stated that the One-Time Inspection program will include the loss of material for nickel alloy thermowell in the sample population. The staff's concern described in RAI 3.2.2.2-1 is resolved.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program and One-Time Inspection program are documented in SER Sections 3.0.3.1. The applicant's Water Chemistry Control – Primary and Secondary 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.

3.2.2.3.3 Containment Penetrations – Summary of Aging Management Review – LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the containment penetrations component groups.

Stainless Steel Closure Bolting Exposed to Treated Borated Water (External). In LRA Table 3.2.2-3, the applicant stated that stainless steel closure bolting exposed externally to treated borated water will be managed for loss of material by the Bolting Integrity program. The AMR item cited generic note H. By letter dated October 13, 2016, the applicant revised LRA Table 3.2.2-3 to remove the AMR items associated with stainless steel closure bolting exposed externally to treated borated water. In its October 13, 2016, letter the applicant clarified that the stainless steel closure bolting is located in the fuel transfer tube flange cover and it is not exposed to a submerged environment in treated borated water because the bolts are removed during refueling activities when the flange is submerged; therefore, the bolts are exposed to an air indoor environment and not treated borated water. The revision to the LRA was made in response to RAI B.1.1-1, issued by letter dated September 15, 2016, which requested, in part, that the applicant describe the frequency and methods of inspection to be used under the Bolting Integrity program to detect the aging effects of loss of material and loss of preload on submerged closure bolting. The staff's discussion of its concerns and evaluation of the applicant's response associated with RAI B.1.1-1 are resolved and documented in SER Section 3.0.3.2.1.

The staff finds the revision acceptable because: (1) the applicant clarified that bolts are exposed to an air indoor environment and not submerged in treated borated water, and (2) the staff confirmed in revised LRA Table 3.2.2-3 that the applicant assigned AMR item 3.2.1-15 to manage under the Bolting Integrity program the aging effect of loss of preload for the stainless steel closure bolts exposed externally to air indoor environment, consistent with the GALL Report.

3.2.2.3.4 ESF Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Review – LRA Tables 3.2.2-4-1 and 3.2.2-4-2

The staff reviewed LRA Tables 3.2.2-4-1 and 3.2.2-4-2, which summarize the results of AMR evaluations for the containment spray system and safety injection system nonsafety-related components affecting safety-related systems component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for these component groups are consistent with the GALL Report.

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 <u>Aging Management of Auxiliary Systems</u>

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components of the following:

- Chemical and Volume Control
- Chilled Water
- Component Cooling and Auxiliary Component Cooling Water
- Compressed Air
- Containment Cooling HVAC
- Control Room HVAC
- Emergency Diesel Generator
- Fire Protection – Water
- Fire Protection RCP Oil Collection
- Fuel Pool Cooling and Purification
- Nitrogen
- Miscellaneous HVAC
- Auxiliary Diesel Generator
- Plant Drains
- Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

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 Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary 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 CRs 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 WF3 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 3.3.2.1.18.

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)

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, 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	Water Chemistry Control – Primary and Secondary, and One-Time Inspection	Consistent with the GALL Report (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, and One-Time Inspection	Consistent with the GALL Report (see SER Section 3.3.2.2.3)
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 to WF3	Not Applicable (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	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	Inservice Inspection	Consistent with the GALL Report
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	Inservice 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, 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	Boric Acid Corrosion (only for steel components; NA for aluminum or copper alloy (> 15% Zn or > 8% Al))	Consistent with the GALL Report
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	Bolting Integrity	Consistent with the GALL Report
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	Bolting Integrity	Consistent with the GALL Report
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 used	Not Used (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

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) (3.3.1-16)	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 (BWR Only)	Not Applicable
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3
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	Not Used	Not Used
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	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	Not Applicable (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable

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
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 to WF3	Not Applicable to WF3 (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 (BWR Only)	Not Applicable
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	Not Applicable (BWR Only)	Not Applicable
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 to WF3	Not Applicable to WF3
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	Not Applicable (BWR Only)	Not Applicable
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	Water Chemistry Control – Primary and Secondary 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 (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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.2)
Fiberglass, HDPE piping, piping components, and piping elements exposed to raw water (internal) (3.3.1-30.5)	Cracking, blistering, change in color due to water absorption	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	Not Applicable to WF3	Not Applicable to WF3
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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.3)
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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.5)
Elastomer seals and components exposed to raw water (3.3.1-32.5)	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 to WF3	Not Applicable to WF3
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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.8)

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
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3
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	Service Water Integrity	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	Service Water Integrity	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 Used	Not Used (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	Service Water Integrity and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.7)

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 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	Not Used	Not Used (see SER section 3.3.2.1.1)
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	Service Water Integrity and Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report (see SER Section 3.3.2.1.17)
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	Water Chemistry Control – 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	Water Chemistry Control – 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	Water Chemistry Control – 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	Water Chemistry Control – 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 (BWR Only)	Not Applicable to WF3 (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
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 to WF3	Not Applicable to WF3 (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	Water Chemistry Control – Closed Treated Water Systems	Consistent with the GALL Report
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	Water Chemistry Control – 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 to WF3	Not Applicable to WF3
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	Not used (See SER Section 3.3.2.1.1)
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

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: 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	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	Consistent with the GALL Report
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

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 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	Consistent with the GALL Report
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	Consistent with the GALL Report (see SER Section 3.3.2.1.12)
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	Not Applicable to WF3	Not Applicable to WF3
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	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 Used	Not Used
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	Diesel Fuel Monitoring 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
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	Diesel Fuel Monitoring and One-Time Inspection	Consistent with the GALL Report
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	Diesel Fuel Monitoring 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	Diesel Fuel Monitoring 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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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 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 to WF3	Not Applicable to WF3
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 and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.6)
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 to WF3	Not Applicable to WF3
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 and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.9)
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	External Surfaces Monitoring	Consistent with the GALL Report
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	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, 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	External Surfaces Monitoring	Consistent with the GALL Report
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	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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.4)
The SRP-LR, as amended by ISGs, does not list an Item No. (3.3.1-84)	N/A	N/A	N/A	N/A	N/A
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	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, 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	Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
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	Not Applicable to WF3	Not Applicable to WF3
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	Internal Surfaces in Miscellaneous Piping and Ducting Components and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.11)
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	Compressed Air Monitoring	Consistent with the GALL Report (see SER Section 3.3.2.1.14)
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
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	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
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	Internal Surfaces in Miscellaneous Piping and Ducting Components and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.14)
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	Internal Surfaces in Miscellaneous Piping and Ducting Components and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.15)
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	Oil Analysis, One-Time Inspection, and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.10)
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	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	Oil Analysis 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
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	Oil Analysis, One-Time Inspection, Periodic Surveillance and Preventive Maintenance, and External Surfaces Monitoring	Consistent with the GALL Report (see SER Section 3.3.2.1.14)
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	Not Applicable to WF3	Not Applicable
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	Neutron-Absorbing Material Monitoring and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3
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	Buried and Underground Piping and Tanks 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 (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 and Tanks Inspection	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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 and Tanks Inspection	Consistent with the GALL Report
Underground aluminum, copper alloy, stainless steel, nickel alloy steel piping, piping components, and piping elements (3.3.1-109.5)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, “Buried and Underground Piping and Tanks”	No	Not Applicable to WF3	Not Applicable to WF3
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 (BWR Only)	Not Applicable
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 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
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
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 (see SER Section 3.3.2.1.13)
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
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 to WF3	Not Applicable
Galvanized steel piping, piping components, and piping elements exposed to air - indoor, uncontrolled (3.3.1-116)	None	None	NA - No AEM or AMP	Not Used	Not Used

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, 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	Not Applicable to WF3	Not Applicable to WF3
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
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	No	Consistent with the GALL Report	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), air – dry, gas (3.3.1-121)	None	None	No	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
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary 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
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	Service Water Integrity	Consistent with the GALL Report (see SER Section 3.3.2.1.18)
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	Fire Water System	Consistent with the GALL Report (see SER Section 3.3.2.2.8)
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 to WF3	Not Applicable to WF3
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	Fire Water System	Consistent with the GALL Report (see SER Section 3.3.2.1.10)
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"	No	Fire 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
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 and Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report (see SER Section 3.3.2.1.12)
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	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 to WF3	Not Applicable to WF3
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	Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.7)

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 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	External Surfaces Monitoring and Periodic Surveillance and Preventive Maintenance	Consistent with the GALL Report (see SER Section 3.3.2.1.15)
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	Fire Water System	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3
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	Coating 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
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	Coating Integrity	Consistent with the GALL Report
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	Coating Integrity	Consistent with the GALL Report

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
- Boric Acid Corrosion
- Buried and Underground Piping and Tanks Inspection
- Coating Integrity
- Compressed Air Monitoring
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Water System
- Flow-Accelerated Corrosion
- Inservice Inspection
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Neutron-Absorbing Materials Monitoring
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Service Water Integrity
- TLAA – Metal Fatigue
- Water Chemistry Control – Closed Treated Water Systems
- Water Chemistry Control – Primary and Secondary

LRA Tables 3.3.2-1 through 3.3.2-15-36 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 3.3.1-16, 3.3.1-21, 3.3.1-22, 3.3.1-24, 3.3.1-25, 3.3.1-27, 3.3.1-47, and 3.3.1-110, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to WF3, which is a CE plant-designed PWR.

For LRA Table 3.3.1, items 3.3.1-5, 3.3.1-18, 3.3.1-19, 3.3.1-23, 3.3.1-26, 3.3.1-27, 3.3.1-30.5, 3.3.1-32.5, 3.3.1-34, 3.3.1-35, 3.3.1-36, 3.3.1-48, 3.3.1-51, 3.3.1-65, 3.3.1-67, 3.3.1-73, 3.3.1-74, 3.3.1-75, 3.3.1-77, 3.3.1-85, 3.3.1-86, 3.3.1-90, 3.3.1-101, 3.3.1-104, 3.3.1-107, 3.3.1-108, 3.3.1-109.5, 3.3.1-115, 3.3.1-118, 3.3.1-122, 3.3.1-123, 3.3.1-128, 3.3.1-133, and 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 WF3. The staff reviewed the LRA and FSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

For LRA Table 3.3.1, items 3.3.1-39 and 3.3.1-41, the applicant claimed that the corresponding items the GALL Report are not used because the component, material, and environment combinations are addressed under alternative AMR items. The staff evaluated the applicant's claim and finds it acceptable because the alternative AMR items are appropriate for the component, material, and environment combinations. The adequacy of the alternative items to manage the effects of aging for these AMR items was evaluated within their respective systems and component groups.

For LRA Table 3.3.1, item 3.3.1-111, the applicant claimed that the corresponding items in the GALL Report are not used because they are addressed by other items in LRA Table 3.5.1. The staff reviewed the LRA and confirmed that the aging effects will be addressed by other LRA Table 3.5.1 items. Therefore, the staff finds the applicant's proposal acceptable. SER Table 3.5-1 identifies the LRA Table 3.5.1 items that address these not applicable items.

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 FSAR 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 it did not use item 3.3.1-13 because: (1) this component group is assigned to LRA Table 3.3.1, item 3.3.1-12, which addresses, under the Bolting Integrity AMP, loss of material of steel bolting exposed to an air environment; and (2) the applicant did not consider steam or water leakage to be a separate aspect of the air indoor environment. The staff reviewed LRA Section 3.3 and confirmed that the applicant used item 3.3.1-12 for the component group associated with item 3.3.1-13. The staff evaluated the applicant's claim and finds it acceptable because the applicant evaluated and addressed the AERM for steel closure bolting exposed to

air with steam or water leakage with LRA Table 3.2.1, item 3.2.1-13, which manages loss of material under the Bolting Integrity program, and this is consistent with the GALL Report.

LRA Table 3.3.1, item 3.3.1-53, addresses steel cranes – rails exposed to air – indoor, uncontrolled (external). The GALL Report recommends AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems” to manage loss of material due to wear for this component group. The applicant stated that LRA item 3.3.1-53 manages the aging effects for loss of material due to wear but remarks that the management of loss of material is accomplished through visual inspections under the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program.

The staff reviewed the applicant’s claim of applicability and noted that LRA item 3.3.1-53 is not used in any LRA Table 2 (Tables 3.x.2-y) AMR results. Instead, the LRA supports AERMs for loss of material through item 3.3.1-52, which the SRP-LR recognizes as appropriate for loss of material due to general corrosion. The staff also noted the applicant stated that item 3.3.1-52, as used, is consistent with the GALL Report for loss of material for steel crane rails and structural girders exposed to air-indoor to be managed by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (Inspection of OVHLL) program. Furthermore, item 3.3.1-52 is used for AMR results presented in LRA Tables 3.5.2-y.

The staff reviewed LRA Table 3.5.2-1, “Reactor Building,” and Table 3.5.2-2, “Nuclear Plant Island Structure,” and verified that the applicant uses SRP-LR item 3.3.1-52 for AMR, for loss of material without any consideration to aging mechanisms triggering this aging effect. The staff notes that both SRP-LR items 3.3.1-52 and 3.3.1-53 address the same aging effect (i.e., loss of material) requiring management AERM for similar components (crane rails and girders versus crane rails). The staff also notes that the material, environment, aging effect, and program (MEAP) (i.e., steel, air – outdoor, GALL Report AMP XI.M23 for both SRP-LR items 3.3.1-52 and 3.3.1-53 are the same. The staff further notes that SRP-LR, Section A.1, “Aging Management Review – Generic (Branch Technical Position RLSB-1)” states, in part, that although “determination of applicable aging effects is based on degradation mechanisms that have occurred and those that potentially could cause structure and component degradation … [s]pecific identification of aging mechanisms is not a requirement.” The staff further notes, the LRA states that cranes and hoists meet the provisions of NUREG–0612, “Control of Heavy Loads at Nuclear Power Plants,” (ADAMS Accession No. ML070250180). NUREG–0612 discusses periodic inspection and testing of cranes including wear and specifies conformance of cranes and hoists to the American National Standard, American Society of Mechanical Engineers (ANS/ASME) B30.2, “Overhead and Gantry Cranes,” safety standard further detailing procedures for corrosion and wear of cranes. Moreover, the ASME B30.2 is implemented in the proposed enhanced Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems AMP, the review of which is documented in SER Section 3.0.3.X.Y. LRA Section 4.7.1, “Crane Load Cycle Analysis,” indicates that the polar crane, the FHB crane, and the radwaste cask handling bridge crane meet the CMAA-70 Class A1 service criteria (i.e., standby service usage with less than 100,000 cycles). Recommendations for the design of crane structural components (e.g., rails, girders) for “maximum life and minimum maintenance” are included in the Crane Manufacturers Association of America Specification No. 70 (CMAA-70).

Finally, the staff verified that the proposed FSAR for the proposed to be enhanced LRA AMP B.17 includes wording for managing the aging effect for loss of material due to wear, stating in part:

> The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program performs periodic visual examinations and preventive maintenance to manage loss of material due to corrosion…and rail wear of cranes and hoists within the scope of license renewal and subject to an AMR, based on industry standards and guidance documents.

The staff finds the proposed approach acceptable because the two AMR items (3.3.1-52 and 3.3.1-53) address the same AERM, loss of material for crane rail components and MEAP. Moreover, the effects of aging for loss of material due to corrosion or limited wear for the infrequently used CMAA-70 cranes are managed by LRA item 3.3.1-52 through the proposed to be enhanced Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program for corrosion/wear.

LRA Table 3.3.1, item 3.3.1-103, addresses reinforced concrete and asbestos cement piping, piping components, and piping elements exposed to soil or concrete. The GALL Report recommends GALL Report AMP XI.M41, "Buried and Underground Piping and Tanks," to manage cracking due to aggressive chemical attack and changes in material properties due to aggressive chemical attack. The applicant stated that these items are not applicable because this material-environment-aging effect combination is addressed with LRA item 3.3.1-105. The staff evaluated the applicant's claim and found it acceptable because the staff verified that reinforced concrete and asbestos cement components exposed to soil or concrete in the auxiliary systems reference LRA item 3.3.1-105, which manages cracking and spalling in a manner consistent with LRA item 3.3.1-103 and GALL Report recommendations.

LRA Table 3.3.1, item 3.3.1-116, addresses galvanized steel piping, piping components, and piping elements exposed to uncontrolled indoor air and states that the item is not applicable because the galvanized (zinc) coating applied to some steel components is not credited for corrosion protection for license renewal. SRP-LR item 3.3.1-116 recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group exposed to this environment. The staff noted that LRA Table 3.3.1 contains AMR items for (ungalvanized) steel and therefore, the staff finds the applicant's claim acceptable.

3.3.2.1.2 Change in Material Properties Due to Aggressive Chemical Attack

LRA Table 3.3.1, item 3.3.1-30, addresses the interior of concrete piping exposed to raw water, which will be managed for changes to material properties due to aggressive chemical attack. For the AMR item that cites generic note E, the LRA credits the One-Time Inspection program to manage the aging effect for concrete piping. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's One-Time Inspection program is documented in SER Section 3.0.3.1.13. The staff noted that the One-Time Inspection program proposes to manage the effects of aging for concrete piping through the use of a one-time visual inspection to verify no significant aging is occurring. During the license renewal AMP audit, the staff reviewed an inspection report which indicated that the concrete piping had experienced minor degradation and should be inspected again in the future. Based on this report, it was unclear to the staff why it was appropriate for the piping to be managed by a one-time confirmatory inspection. By letter dated October 12, 2016, the staff issued RAI B.1.28-2 requesting that the applicant explain why it is appropriate to manage the effects of aging on concrete portions of the

circulating water intake piping exposed to raw water via the One-Time Inspection program, considering the guidance in the GALL Report and the operating experience described in the reviewed report.

In its response, dated January 9, 2017, and revised March 16, 2017, the applicant proposed to manage the effects of aging via reoccurring visual inspections, conducted every 10 years under the PSPM program. The applicant revised LRA Table 3.3.1, item 3.3.1-30, accordingly.

The staff finds the applicant's response acceptable because the component is receiving the recommended visual inspections on an acceptable frequency. The staff's concern described in RAI B.1.28-2 is resolved. Additional discussion on the technical adequacy of the RAI response and the associated change can be found in the staff's write-up of the PSPM program (SER Section 3.0.3.3.1).

Based on its review of components associated with item 3.3.1-30 for which the applicant cited generic note E, and the response to RAI B.1.28-2, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the component is receiving the recommended visual inspections on an acceptable frequency.

The staff concludes that for LRA item 3.3.1-30, 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).

3.3.2.1.3 Cracking Due to Settling

LRA Table 3.3.1, item 3.3.1-31, addresses the interior of concrete piping exposed to raw water, which will be managed for cracking due to settling. For the AMR item that cites generic note E, the LRA credits the One-Time Inspection program to manage the aging effect for concrete piping. The GALL Report recommends GALL Report AMP XI.M20, “Open-Cycle Cooling Water System,” to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's One-Time Inspection program is documented in SER Section 3.0.3.1.13. The staff noted that the One-Time Inspection program proposes to manage the effects of aging for concrete piping through the use of a one-time visual inspection to verify no significant aging is occurring. During the license renewal AMP audit, the staff reviewed an inspection report that indicated the concrete piping had experienced minor degradation and should be inspected again in the future. Based on this report, it was unclear to the staff why it was appropriate for the piping to be managed by a one-time confirmatory inspection. By letter dated October 12, 2016, the staff issued RAI B.1.28-2 requesting that the applicant explain why it is appropriate to manage the effects of aging on concrete portions of the circulating water intake piping exposed to raw water via the One-Time Inspection program, considering the guidance in the GALL Report and the operating experience described in the reviewed report.

In its response, dated January 9, 2017, and revised March 16, 2017, the applicant proposed to manage the effects of aging via reoccurring visual inspections, conducted every 10 years under the PSPM program. The applicant revised LRA Table 3.3.1, item 3.3.1-31, accordingly.

The staff finds the applicant’s response acceptable because the component is receiving the recommended visual inspections on an acceptable frequency. The staff’s concern described in RAI B.1.28-2 is resolved. Additional discussion on the technical adequacy of the RAI response and the associated changes can be found in the staff’s write-up of the PSPM program (SER Section 3.0.3.3.1).

Based on its review of components associated with item 3.3.1-31 for which the applicant cited generic note E, and the response to RAI B.1.28-2, the staff finds the applicant’s proposal to manage the effects of aging using the PSPM program acceptable because the component is receiving the recommended visual inspections on an acceptable frequency.

The staff concludes that for LRA item 3.3.1-31, 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 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3.1, item 3.3.1-83, addresses stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust, which will be managed for cracking due to SCC. For the AMR item that cites generic note E, the LRA credits the PSPM program to manage the aging effect for the stainless steel expansion joints. The GALL Report recommends GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” to manage this aging effect by performing visual inspections during maintenance activities, surveillances, and scheduled outages. In addition, GALL Report AMP XI.M38 recommends that a minimum number of inspections for a representative sample be performed in each 10-year period during the period of extended operation.

The staff’s evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for the stainless steel expansion joint through monitoring the surface condition of the expansion joint at least once every 5 years to verify the absence of cracking due to SCC. However, it was unclear to the staff what inspection activities were included in monitoring the surface condition of the stainless steel expansion joints. By letter dated October 12, 2016, the staff issued RAI B.1.30-3 requesting that the applicant provide details about the monitoring activities in the PSPM program for the surface condition of the EDG stainless steel expansion joints to verify the absence of cracking. The staff’s evaluation of the applicant’s response and the resolution of the concern in RAI B.1.30-3 is documented in SER Section 3.0.3.3.1.

Based on its review of components associated with item 3.3.1-83 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections every 5 years that are capable of detecting cracking due to SCC from stainless steel expansion joints prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-83, 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 Cracking and Change in Material Properties Due to Aggressive Chemical Attack

LRA Table 3.3.1, item 3.3.1-32, addresses the interior of concrete piping exposed to raw water, which will be managed for cracking and changes to material properties due to aggressive chemical attack. For the AMR item that cites generic note E, the LRA credits the One-Time Inspection program to manage these aging effects for concrete piping. The GALL Report recommends GALL Report AMP XI.M20, "Open-Cycle Cooling Water System," to provide reasonable assurance that these aging effects are adequately managed. GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's One-Time Inspection program is documented in SER Section 3.0.3.1.13. The staff noted that the One-Time Inspection program proposes to manage the effects of aging for concrete piping through the use of a one-time visual inspection to verify no significant aging is occurring. During the license renewal AMP audit, the staff reviewed an inspection report that indicated the concrete piping had experienced minor degradation and should be inspected again in the future. Based on this report, it was unclear to the staff why it was appropriate for the piping to be managed by a one-time confirmatory inspection. By letter dated October 12, 2016, the staff issued RAI B.1.28-2 requesting that the applicant explain why it is appropriate to manage the effects of aging on concrete portions of the circulating water intake piping exposed to raw water via the One-Time Inspection program, considering the guidance in the GALL Report and the operating experience described in the reviewed report.

In its response, dated January 9, 2017, and revised March 16, 2017, the applicant proposed to manage the effects of aging via reoccurring visual inspections, conducted every 10 years under the PSPM program. The applicant revised LRA Table 3.3.1, item 3.3.1-32, accordingly.

The staff finds the applicant's response acceptable because the component is receiving the recommended visual inspections on an acceptable frequency. The staff's concern described in RAI B.1.28-2 is resolved. Additional discussion on the technical adequacy of the RAI response and the associated changes can be found in the staff's write-up of the PSPM program (SER Section 3.0.3.3.1).

Based on its review of components associated with item 3.3.1-32 for which the applicant cited generic note E, and the response to RAI B.1.28-2, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the component is receiving the recommended visual inspections on an acceptable frequency.

The staff concludes that for LRA item 3.3.1-32, 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 Hardening and Loss of Strength Due to Elastomer Degradation

LRA Table 3.3.1, item 3.3.1-76, addresses elastomer seals and components exposed to air-indoor (uncontrolled), which will be managed for hardening and loss of strength due to elastomer degradation. For the ducting used with the portable smoke exhaust fan in the control room HVAC system that cites generic note E, the LRA credits the PSPM program to manage changes in material properties and cracking. The GALL Report recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to manage these aging effects. Although cracking is not specifically addressed in this SRP-LR item, the staff

notes that, as discussed in GALL Report AMP XI.M36, the presence of cracking is an indirect indicator of flexible polymer hardening and loss of strength. GALL Report AMP XI.M36 recommends periodic visual inspections augmented by physical manipulation at least once per refueling outage to manage the effects of aging.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for the elastomeric ducting through the use of visual inspections every 5 years; however, it was unclear to the staff if physical manipulation would be used to augment visual inspection based on conflicting information in the LRA. By letter dated October 12, 2016, the staff issued RAI B.1.30-2 requesting that the applicant clarify whether physical manipulation would be used to augment visual inspection of the elastomeric portable smoke-ejector duct. The staff's evaluation of the applicant's response to RAI B.1.30-2 is documented in SER Section 3.0.3.3.1, which clarified that physical manipulation will be used to augment visual inspection of the elastomeric portable smoke-ejector ducting. The staff also noted that the inspection frequency is non-conservative when compared to the recommendations in AMP XI.M36; however, the staff finds that inspections at least once every 5 years are capable of detecting hardening and loss of strength prior to the loss of component intended function for this combination of material and environment. Based on its review of components associated with item 3.3.1-76 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections augmented by physical manipulation that are capable of detecting hardening and loss of strength due to elastomer degradation prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-76, 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 and Fouling

LRA Table 3.3.1, item 3.3.1-40, as modified by letter dated February 23, 2017, addresses stainless steel piping components exposed to raw water, which are managed for loss of material and fouling. For the AMR item that cites generic note E, the LRA credits the PSPM program to manage loss of material that could result in flow blockage of the wet cooling tower spray nozzles. The GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M20 recommends using the guidance in GL 89-13, which includes routine inspections to identify degradation due to corrosion product accumulation and biofouling.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff notes that, in response to RAI B.1.36-1a, the applicant revised this program to perform periodic visual inspections of the wet cooling tower spray nozzles. Based on its review of components associated with item 3.3.1-40 that cite generic note E, the staff finds the applicant's proposal to manage aging effects using the PSPM program acceptable because fouling can be identified using periodic visual inspections and any consequent flow blockage can be addressed.

LRA Table 3.3.1, item 3.3.1-134, as modified by letter dated February 23, 2017, addresses steel piping components exposed to raw water, which are managed for loss of material and fouling. For the AMR item that cites generic note E, the LRA credits the PSPM program to manage flow

blockage due to fouling of the anti-siphon holes in the chemical addition and filtration system for the wet cooling tower basins. The GALL Report recommends AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” to manage the aging effects associated with this AMR item by using periodic visual inspections.

The staff’s evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff notes that, in response to RAI B.1.36-2a associated with the Service Water Integrity program, the applicant revised the PSPM program to perform periodic visual inspections of the associated anti-siphon holes. Based on its review of components associated with item 3.3.1-134 that cite generic note E, the staff finds the applicant’s proposal to manage aging effects using the PSPM program acceptable because periodic visual inspections can readily identify fouling and any consequent flow blockage can be addressed.

3.3.2.1.8 Loss of Material Due to Abrasion, Cavitation, Aggressive Chemical Attack

LRA Table 3.3.1, item 3.3.1-33, addresses the interior of concrete piping exposed to raw water, which will be managed for loss of material due to abrasion, cavitation, and aggressive chemical attack. For the AMR item that cites generic note E, the LRA credits the One-Time Inspection program to manage the aging effect for concrete piping. The GALL Report recommends GALL Report AMP XI.M20, “Open-Cycle Cooling Water System,” to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.M20 recommends using periodic visual inspections to manage the effects of aging.

The staff’s evaluation of the applicant’s One-Time Inspection program is documented in SER Section 3.0.3.1.13. The staff noted that the One-Time Inspection program proposes to manage the effects of aging for concrete piping through the use of a one-time visual inspection to verify no significant aging is occurring. During the license renewal AMP audit, the staff reviewed an inspection report that indicated the concrete piping had experienced minor degradation and should be inspected again in the future. Based on this report, it was unclear to the staff why it was appropriate for the piping to be managed by a one-time confirmatory inspection. By letter dated October 12, 2016, the staff issued RAI B.1.28-2 requesting that the applicant explain why it is appropriate to manage the effects of aging on concrete portions of the circulating water intake piping exposed to raw water via the One-Time Inspection program, considering the guidance in the GALL Report and the operating experience described in the reviewed report.

In its response, dated January 9, 2017, and revised March 16, 2017, the applicant proposed to manage the effects of aging via reoccurring visual inspections, conducted every 10 years under the PSPM program. The applicant revised LRA Table 3.3.1, item 3.3.1-33, accordingly.

The staff finds the applicant’s response acceptable because the component is receiving the recommended visual inspections on an acceptable frequency. The staff’s concern described in RAI B.1.28-2 is resolved. Additional discussion on the technical adequacy of the RAI response and the associated changes can be found in the staff’s write-up of the PSPM program (SER Section 3.0.3.3.1).

Based on its review of components associated with item 3.3.1-33 for which the applicant cited generic note E, and the response to RAI B.1.28-2, the staff finds the applicant’s proposal to manage the effects of aging using the PSPM program acceptable because the component is receiving the recommended visual inspections on an acceptable frequency.

The staff concludes that for LRA item 3.3.1-33, 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 Loss of Material Due to General Corrosion

LRA Table 3.3.1, item 3.3.1-78, addresses steel piping, ducting, and components exposed to air-indoor (uncontrolled) that will be managed for loss of material due to general corrosion. For the AMR item that cites generic note E, the LRA credits the PSPM program to manage the aging effect for the portable carbon steel smoke exhaust fan housing. The GALL Report recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," to manage this aging effect and recommends periodic visual inspections at least once per refueling outage to manage the effects of aging.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for the portable carbon steel smoke exhaust fan housing through the use of visual inspections at least once every 5 years. The staff noted that this inspection frequency is non-conservative when compared to the recommendations in AMP XI.M36; however, the staff finds that inspections at least once every 5 years are capable of detecting loss of material prior to the loss of component intended function for this combination of material and environment. Based on its review of components associated with item 3.3.1-78 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting the loss of material from metallic components prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

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).

3.3.2.1.10 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-97, addresses steel piping, piping components, and piping elements and steel RCP oil collection system components exposed to lubricating oil that will be managed for loss of material due to general, pitting, and crevice corrosion. For AMR items that cite generic note E, the LRA credits the PSPM program to manage the aging effect for carbon steel sight glasses, piping, tanks, enclosures, drip pans, and valve bodies. The GALL Report recommends GALL Report AMPs XI.M39, "Lubricating Oil Analysis," and XI.M32, "One-Time Inspection," to manage this aging effect. GALL Report AMP XI.M39 recommends performing periodic sampling and testing of lubricating oil for moisture and corrosion particles in accordance with industry standards to manage the effects of aging. GALL Report AMP XI.M32 recommends a one-time inspection of selected components to verify the effectiveness of the AMP that is designed to minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. In addition, GALL Report AMP XI.M32 recommends a minimum representative sample of 20 percent of the population with a maximum of 25 components.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for carbon steel components through the use of visual inspections at least once every 5 years with a minimum representative sample of 20 percent of the population with a maximum of 25 components. The staff notes that the applicant's proposal provides for periodic visual inspections in lieu of a one-time inspection and periodic testing of the lubricating oil. Based on its review of components associated with item 3.3.1-97 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting the loss of material from metallic components prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-97, 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).

LRA Table 3.3.1, item 3.3.1-129, addresses steel tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, and condensation, 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 Fire Water System program to manage the aging effect for steel fire water storage tanks exposed to soil or concrete. The GALL Report recommends GALL Report AMP XI.M29, "Aboveground Metallic Tanks," to provide reasonable assurance that this aging effect is adequately managed. However, as modified by LR-ISG-2012-02, AMP XI.M29 cites AMP XI.M27 to manage aging effects associated with fire water storage tanks.

The staff's evaluation of the applicant's Fire Water System program is documented in SER Section 3.0.3.2.9. The staff noted that the Fire Water System program proposes to manage the effects of aging for steel fire water storage tanks through the use of periodic visual inspections augmented by volumetric wall thickness examinations and vacuum box testing of bottom seam welds when signs of pitting, corrosion, or failure of the coating is noted. In addition, bottom thickness measurements are conducted on each fire water storage tank during the first 10-year period of the period of extended operation. Based on its review of components associated with item 3.3.1-129 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Fire water System program acceptable because the visual and volumetric examinations are capable of detecting loss of material in steel fire water storage tanks.

The staff concludes that for LRA item 3.3.1-129, 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).

3.3.2.1.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-91 addresses steel piping, piping components, piping elements, and tanks exposed to waste water, which will be managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion. For the AMR items that cite generic note E, the LRA credits the PSPM program to manage the aging effect for the internal surfaces

of abandoned in place carbon steel valve bodies, piping, traps, pump casings, accumulators, and sight glasses. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage this aging effect by performing visual inspections during maintenance activities, surveillances, and scheduled outages. In addition, GALL Report AMP XI.M38 recommends that a minimum number of inspections for a representative sample be performed in each 10-year period during the period of extended operation and that the acceptance criteria for metallic components be that no abnormal surface conditions are present.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for carbon steel components through the use of visual inspections capable of detecting abnormal surface conditions at least once every 5 years with a minimum representative sample of 20 percent of the population with a maximum of 25 components. Based on its review of components associated with item 3.3.1-91 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting the loss of material from metallic components before the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-91 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).

3.3.2.1.12 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion; Fouling that Leads to Corrosion; Flow Blockage Due to Fouling

LRA Table 3.3.1, item 3.3.1-64, addresses steel, copper-alloy piping, piping components, and piping elements exposed to raw water, which will be managed for loss of material, fouling that leads to corrosion, and flow blockage due to fouling. The GALL Report recommends GALL Report AMP XI.M27 as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," to provide reasonable assurance that these aging effects are adequately managed.

During its review of components associated with item 3.3.1-64 for which the applicant cited generic note D, the staff noted that the LRA credits the Fire Water System program to manage loss of material for copper-alloy heat exchanger tubes. The staff recognizes that visual inspections can be capable of detecting pitting and crevice corrosion in heat exchanger tubes. However, copper-alloy materials are also susceptible to loss of material due to general corrosion. The staff has concluded that visual inspections will not effectively detect general corrosion in heat exchanger tubes when the corrosion is uniform. By letter dated October 12, 2016, the staff issued RAI 3.3.1-1 (FWS AMR-1) requesting that the applicant state the method that will be used in the Fire Water System program to detect loss of material due to general corrosion in copper-alloy tubes exposed to raw water.

In its response dated November 10, 2016, the applicant stated that the makeup source for the fire water system is the potable water system. The applicant also stated that consistent with SRP-LR Table 3.3-1, item 3.3.1-93, copper-alloy piping exposed to raw water (potable) is not susceptible to general corrosion.

The staff noted that, LRA Section 2.3.3.8, "Fire Protection: Water," states: [t]he treated water system is no longer used for processing raw water from the Mississippi River. The treated water system has been inactivated except for the clearwell tank, clearwell transfer pumps, bearing lubrication water pumps for the circulating water pumps, and associated piping, valves, instrumentation, and controls." The staff also noted that LRA Section 2.3.3.15, "Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)," states:

> [t]he purpose of the potable water (PW) system is to distribute water from the St. Charles Parish Water System throughout the plant site. The system provides potable water, both hot and cold, for drinking water, sanitary services, and emergency showers and eyewash stations. The distribution system also supplies makeup water to the fire water storage tanks and to the primary water treatment plant clearwell tank.

The staff further noted that FSAR Section 9.5.1.2.2 (b) states: [t]he makeup water supply to the water storage tanks is capable of filling either tank within an 8-hour period. The tanks are filled directly from the potable water system or by pumps drawing suction from the Primary Water Treatment System clear well, which is supplied with either filtered Mississippi River water or Parish water." Based on the text in the LRA and FSAR, it is not clear to the staff whether the LRA is correct and the FSAR is out of date, or if there is some other interpretation of the wording, "which is supplied with either filtered Mississippi River water or Parish water." The staff is concerned that with the wording in the CLB (i.e., FSAR Section 9.5.1.2.2 (b)), filtered Mississippi River water could become a normal source of makeup for the fire water system.

By letter dated December 2, 2016, the staff issued RAI 3.3.1-1a requesting that the applicant clarify whether FSAR Section 9.5.1.2.2 (b) is stating that filtered Mississippi River water could be a normal source of makeup for the fire water system, and if FSAR Section 9.5.1.2.2(b) is in error or out of date, and to state whether the condition has been documented in the corrective action program.

In its response dated January 16, 2017, the applicant stated that, "UFSAR Section 9.2.3.1.1 correctly indicates that the primary water treatment plant is no longer used for processing raw water from the Mississippi River. UFSAR Section 9.5.1.2.2 (b) is in error. The condition has been entered into the corrective action program for correction."

The staff finds the applicant's response acceptable because the source of the fire water system makeup is potable water and, consistent with the GALL Report, loss of material due to general corrosion is not an applicable aging effect for copper-alloy materials exposed to potable water. The staff's concern described in RAI 3.3.1-1 (FWS AMR-1) and RAI 3.3.1-1a is resolved.

In addition, the staff noted that flow blockage due to fouling was not identified as an AERM in LRA Table 2s and the "Discussion" section of LRA Table 3.3.1 associated with LRA Table 3.3.1, item 3.3.1-64, as well as other Table 3.3.1 items (i.e., 3.3.1-66, 3.3.1-130, 3.3.1-131, 3.3.1-136). The Fire Water System program, as well as the FSAR supplement for the program, cite flow blockage due to fouling as an applicable aging effect; however, the AMR items do not. By letter dated October 12, 2016, the staff issued RAI 3.3.1-2 (FWS AMR-2) requesting that the applicant state whether flow blockage due to fouling will be managed for components citing LRA Table 3.3.1, items 3.3.1-64, 3.3.1-66, 3.3.1-130, 3.3.1-131, and 3.3.1-136.

In its response dated November 10, 2016, the applicant stated that with the exception of the flame arrestor and connecting steel piping, all items that cite LRA Table 3.3.1, item 3.3.1-131,

state that the Fire Water System program is used to manage associated aging effects. The applicant also stated that all components that cite LRA Table 3.3.1, items 3.3.1-64, 3.3.1-66, and 3.3.1-130, state that the Fire Water System program is used to manage associated aging effects. The applicant concluded that since the Fire Water System program includes provisions to manage flow blockage due to fouling, this aging effect will be managed for the components cited above.

The staff noted that as stated by the applicant, LRA Table 3.3.1, item 3.3.1-136, addresses tanks and does not cite flow blockage due to fouling as an applicable aging effect. The staff cited this item in error. The staff noted that LRA Table 3.3.2-8, "Fire Protection – Water System Summary of Aging Management Evaluation," had not been updated. The staff lacks reasonable assurance that in the absence of citing specific aging effects in LRA Table 3.3.2-8, the correct aging effects will be managed for each applicable item. By letter dated December 2, 2016, the staff issued RAI 3.3.1-2a requesting that the applicant state the basis for why there is reasonable assurance that flow blockage due to fouling will be managed for the items cited above in the absence of LRA Table 3.3.2-8 citing the aging effect.

In its response dated January 16, 2017, the applicant updated LRA Table 3.3.2-8 to cite flow blockage.

The staff finds the applicant's response acceptable because consistent with the GALL Report, flow blockage due to fouling will be managed for fire water system components exposed to raw water and LRA Table 3.3.2-8 has been updated to reflect the addition of the aging effect. The staff's concern described in RAI 3.3.1-2 (FWS AMR-2) and RAI 3.3.1-2a is resolved.

The staff also noted that fouling that leads to corrosion was not identified as an AERM. However, the staff reviewed LRA Table 3.3.1, items 3.3.1-64, 3.3.1-66, 3.3.1-130, 3.3.1-131, and 3.3.1-136, and confirmed that in all cases, loss of material due to various mechanisms (e.g., general, pitting, crevice) was cited as an aging effect in addition to fouling that leads to corrosion. In addition, AMP XI.M27 recommends periodic visual inspections. The staff concluded that there is reasonable assurance that the inspections for loss of material would detect fouling deposits and the presence of fouling deposits would be entered into the applicant's corrective action program. As a result, fouling that leads to corrosion was determined to not be necessary as a standalone AERM.

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).

3.3.2.1.13 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

LRA Table 3.3.1, item 3.3.1-131, addresses 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), which will be managed for loss of material due to general (steel, and copper alloy only), pitting, crevice, and MIC, fouling that leads to corrosion; and flow blockage due to fouling. For the AMR items that cite generic note E, the LRA credits the Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effects for steel flame arrestors and piping exposed

internally to outdoor air. The GALL Report recommends GALL Report AMP XI.M27, “Fire Water System,” to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.M27 recommends using periodic visual examinations and tests to manage the effects of aging.

The staff’s evaluation of the applicant’s Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.6. The staff noted that the Internal Surfaces in Miscellaneous Piping and Ducting Components program proposes to manage the effects of aging for steel flame arrestors and piping through the use of periodic visual examinations of a representative sample of the population of steel components exposed to outdoor air. Flow blockage due to fouling is managed for portions of the fire water systems by periodic visual inspections and tests (e.g., deluge valve tests). While the flame arrestors would not be subject to the specific inspections or tests for flow blockage due to fouling; the LRA does not state the purpose (beyond pressure boundary) of the piping. For example, there is a significant quantity of steel deluge valve piping downstream of the deluge valves that is exposed to outdoor air. This piping is subject to periodic testing for flow blockage due to fouling that would not be conducted if the aging effects are managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components program. By letter dated October 12, 2016, the staff issued RAI 3.3.1-3 (FWS AMR-3) requesting that the applicant state: (a) the purpose of the steel piping exposed to outdoor air for which aging effects are proposed to be managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components program, and (b) if flow blockage due to fouling should be managed for this piping, state the inspections or tests that will be conducted to manage this aging effect.

In its response dated November 10, 2016, the applicant stated that the steel piping with an internal environment of outdoor air is the vent line to which the flame arrestor is connected. The applicant also stated that the flame arrestors and associated vent line piping are not susceptible to flow blockage due to fouling.

The staff noted that the piping connected to the flame arrestor would not normally be susceptible to flow blockage due to fouling because unlike deluge piping exposed to outdoor air, there is no source of water to accelerate corrosion sufficiently to cause flow blockage for the flame arrestor piping. The staff also noted that as with any steel piping exposed to outdoor air, the piping is susceptible to loss of material. The staff finds the applicant’s response acceptable because the flame arrestor and its associated piping would not normally be susceptible to flow blockage due to fouling and because the Internal Surfaces in Miscellaneous Piping and Ducting Components program includes periodic inspections of this material, environment, and aging effect. The staff’s concern described in RAI 3.3.1-3 (FWS AMR-3) is resolved.

Based on its review of components associated with item 3.3.1-131 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable for the reasons cited above.

The staff concludes that for LRA item 3.3.1-131, 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).

3.3.2.1.14 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3.1, item 3.3.1-92, addresses aluminum piping, piping components, and piping elements exposed to internal condensation, 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 Compressed Air Monitoring program to manage the aging effect for aluminum regulator bodies, valve bodies, and filter housings. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to provide reasonable assurance that this aging effect is adequately managed. To manage the effects of aging, GALL Report AMP XI.M38 recommends performing inspections of internal surfaces when the component surfaces become accessible for visual inspection during periodic surveillances or maintenance activities.

The staff's evaluation of the applicant's Compressed Air Monitoring program is documented in SER Section 3.0.3.2.3. The staff noted that the Compressed Air Monitoring program proposes to manage the effects of aging for aluminum regulator bodies, valve bodies, and filter housings of the compressed air systems through the use of periodic and opportunistic visual inspections of accessible internal surfaces of the system components. Based on its review of components associated with item 3.3.1-92 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Compressed Air Monitoring program acceptable because the periodic and opportunistic visual inspections for signs of loss of material of accessible internal surfaces of regulator bodies, valve bodies, and filter housings provide reasonable assurance that the aging effects will be detected before a loss of intended function.

The staff concludes that for LRA item 3.3.1-92, 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).

3.3.2.1.15 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Table 3.3.1, item 3.3.1-95, addresses copper alloy, stainless steel, nickel alloy, and steel piping, piping components, piping elements, heat exchanger components, and tanks exposed to waste water and condensation, which will be managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion. For the AMR items that cite generic note E, the LRA credits the PSPM program to manage the aging effect for the internal surfaces of abandoned in-place carbon steel and stainless steel accumulators, condensers (shell), cooler housings, evaporators, filter housings, flow elements, piping, pump casings, tanks, traps, and valve bodies. The GALL Report recommends GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage this aging effect by performing visual inspections during maintenance activities, surveillances, and scheduled outages. In addition, GALL Report AMP XI.M38 recommends that a minimum number of inspections for a representative sample be performed in each 10-year period during the period of extended operation and that the acceptance criteria for metallic components be that no abnormal surface conditions are present.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that this program proposes to manage the effects of aging for carbon steel and stainless steel components through the use of visual inspections capable of detecting abnormal surface conditions at least once every 5 years with a minimum representative sample of 20 percent of

the population with a maximum of 25 components. Based on its review of components associated with item 3.3.1-95 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting loss of material from metallic components prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-95, 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 3.3.1-100, addresses stainless steel piping, piping components, and piping elements exposed to lubricating oil, which will be managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion. For the stainless steel AMR items in the RCP oil collection system that cite generic note E, the LRA credits either the PSPM program or External Surfaces Monitoring program to manage the aging effect for stainless steel flex hoses, drip pans, tubing, piping, enclosures, and strainers. The GALL Report recommends GALL Report AMPs XI.M39, "Lubricating Oil Analysis," and XI.M32, "One-Time Inspection" to manage this aging effect. GALL Report AMP XI.M39 recommends performing periodic sampling and testing of lubricating oil for moisture and corrosion particles in accordance with industry standards to manage the effects of aging. In addition, GALL Report AMP XI.M32 recommends a one-time inspection of selected components to verify the effectiveness of the AMP that is designed to minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. Further, GALL Report AMP XI.M32 recommends a minimum representative sample of 20 percent of the population with a maximum of 25 components.

The staff's evaluation of the applicant's PSPM program and External Surfaces Monitoring program are documented in SER Sections 3.0.3.3.1 and 3.0.3.2.6, respectively. The staff noted that the LRA proposes to manage the effects of aging for stainless steel components through the use of periodic visual inspections at least once every 5 years (for the PSPM program) or at least once every refueling cycle (for the External Surfaces Monitoring program) with a minimum representative sample of 20 percent of the population with a maximum of 25 components. The staff notes that the applicant's proposal provides for periodic visual inspections in lieu of a one-time inspection and periodic testing of the lubricating oil. Based on its review of components associated with item 3.3.1-100 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the PSPM program and External Surfaces Monitoring program acceptable because the programs include periodic visual inspections that are capable of detecting loss of material from metallic components prior to the loss of the component intended function.

The staff concludes that for LRA item 3.3.1-100, 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 3.3.1-135, addresses steel or stainless steel pump casings submerged in waste water, which will be managed for loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion. For the AMR items that cite generic note E, the LRA credits the PSPM program to manage the aging effect for the internal surfaces of

carbon steel and gray cast iron pump casings. The GALL Report recommends GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” to manage this aging effect by performing periodic visual inspections at least once per refueling outage. GALL Report AMP XI.M36 also states that the program may be credited with managing loss of material from internal surfaces of metallic components when the material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition.

The staff’s evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff noted that the external surfaces of the carbon steel pump casings, which are exposed to waste water, will be managed using the External Surfaces Monitoring program. In addition, the staff noted that the external surface of the gray cast iron pump casings are exposed to outdoor air, not waste water, making item 3.3.1-135 not applicable for the gray cast iron pump casings. However, the GALL Report recommends AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” for this material and environment combination (e.g., LRA Table 3.3.1, item 3.3.1-91), which recommends performing visual inspections in each 10-year period during the period of extended operation. The PSPM program proposes to manage the effects of aging for the internal surfaces of the gray cast iron pump casings through the use of visual inspections at least once every 5 years, which is more conservative than performing visual inspections in each 10-year period as recommended in AMP XI.M38. Based on its review of components associated with item 3.3.1-135 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting the loss of material from metallic components prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-135, 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).

3.3.2.1.16 Loss of Material Due to Wear

LRA Table 3.3.1, item 3.3.1-96, addresses elastomeric seals and components exposed to air-indoor (uncontrolled), which will be managed for loss of material due to wear. For the ducting used with the portable smoke exhaust fan in the control room HVAC system that cites generic note E, the LRA credits the PSPM program to manage the aging effect. The GALL Report recommends GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” to manage this aging effect by performing visual inspections during maintenance activities, surveillances, and scheduled outages. In addition, GALL Report AMP XI.M38 recommends that a minimum number of inspections for a representative sample be performed in each 10-year period during the period of extended operation.

The staff’s evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. Based on its review of components associated with item 3.3.1-96 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the PSPM program acceptable because the program includes visual inspections that are capable of detecting loss of material due to wear from elastomeric components prior to the loss of the component intended function, which is consistent with the GALL Report recommendations.

The staff concludes that for LRA item 3.3.1-96, 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).

3.3.2.1.17 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3.1, item 3.3.1-42, addresses copper, titanium, and stainless steel heat exchanger tubes exposed to raw water, which will be managed for reduction of heat transfer due to fouling. For the AMR item that cites generic note E, the LRA credits the Internal Surfaces in Miscellaneous Piping and Ducting Components program to manage the aging effects for copper-alloy heat exchanger tubes. The GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," to ensure that this aging effect is adequately managed. GALL Report AMP XI.M20 recommends using the guidance in GL 89-13, which includes either heat transfer testing or visual inspections of heat exchanger tubes to verify the absence of fouling.

The staff's evaluation of the Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.6. The staff notes that the related components are part of the Fire Protection – Water System and not associated with GL 89-13. The staff also noted that the above program proposes to manage the aging effects for heat exchanger tubes by using periodic visual inspections. Based on its review of components associated with item 3.3.1-42 that cite generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Internal Surfaces in Miscellaneous Piping and Ducting Components program acceptable because fouling of heat exchanger tubes can be identified using periodic visual inspections and any consequent reduction of heat transfer can be addressed.

3.3.2.1.18 Wall Thinning Due to Erosion

LRA Table 3.3.1, item 3.3.1-126, as modified by letter dated March 16, 2017, addresses any material piping component exposed to several water environments, which will be managed for wall thinning due to erosion. For the AMR item that cites generic note E, the LRA credits the Service Water Integrity program to manage the effects of aging for carbon steel valves exposed to raw water. The GALL Report, through LR-ISG-2012-01, recommends AMP XI.M17, "Flow-Accelerated Corrosion," to manage the wall thinning due to erosion if the aging effect is not already being managed through another AMP. For the associated components, the applicant's Service Water Integrity program currently includes routine activities to perform internal visual inspections of the valves found to be susceptible to erosion due to cavitation.

The staff's evaluation of the Service Water Integrity program is documented in SER Section 3.0.3.2.19. As discussed in its responses to RAIs B.1.36-4 and B.1.36-4a, the applicant's Service Water Integrity program implements the recommendations from GL 89-13 by performing periodic inspections of the associated valves to identify degradation due to erosion. Based on its review of components associated with item 3.3.1-126 that cite generic note E, the staff finds the applicant's proposal to manage aging effects using the Service Water Integrity program acceptable because the ongoing periodic internal visual inspections have been shown to effectively manage loss of material caused by erosion.

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
- 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 3.3.2.2. 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, states that the effects of cumulative fatigue damage due to fatigue of steel cranes – structural girders exposed to air – indoor uncontrolled (external) and stainless steel, steel heat exchanger components and tubes, piping, piping components, and piping elements exposed to treated borated water, air – indoor, uncontrolled, and treated water will be evaluated as a TLAA. The LRA further states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) 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 is, therefore, acceptable. The staff's evaluation of these TLAAs for cumulative fatigue damage are documented in SER Sections 4.3 and 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 stainless steel nonregenerative heat exchanger components exposed to treated borated water greater than 140 °F. The applicant proposes to manage cracking in these components using the Water Chemistry Control – Primary and Secondary program with augmented inspections through the One-Time Inspection program. The criteria in SRP-LR Section 3.3.2.2.2 states that control of water chemistry does not preclude cracking due to SCC and cyclic loading and recommends that a plant-specific program be evaluated to verify the absence of cracking. The SRP-LR also states that an acceptable verification program includes temperature and radioactivity monitoring of the shell side water, and eddy current testing of the heat exchanger tubes. The applicant addressed the further evaluation criteria of the SRP-LR by stating that the Water Chemistry Control – Primary and Secondary program is augmented by the One-Time Inspection program, which will verify the absence of cracking through the use of visual and volumetric NDE techniques. The applicant will also verify the absence of cracking of the tubes and tube sheet

by monitoring RCS leakage and radiation levels in the CCW system. The applicant stated that temperature monitoring is not used since it is a much less sensitive technique.

The staff's evaluations of the applicant's Water Chemistry Control – Primary and Secondary program and One-Time Inspection program are documented in SER Sections 3.0.3.1.19 and 3.0.3.1.13, respectively. The staff notes that the One-Time Inspection program will use established NDE methods, including visual, ultrasonic, and surface techniques to confirm that unacceptable cracking of the heat exchanger tubes is not occurring. In its review of components associated with item 3.3.1-3, the staff finds that the applicant has met the further evaluation criteria, and that the applicant's proposal to manage the effects of aging by augmenting the Water Chemistry Control – Primary and Secondary program with the One-Time Inspection program is acceptable because the absence of cracking will be verified (a) through one-time inspections using established NDE techniques and (b) through monitoring of RCS leakage and radiation levels in the CCW system.

Based on the programs identified, the staff determines that the applicant's programs meet SRP-LR Section 3.3.2.2.2 criteria. For those items associated with LRA Section 3.3.2.2.2, 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).

3.3.2.2.3 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 stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, which will be managed for cracking due to SCC by the External Surfaces Monitoring program. The criteria in SRP-LR Section 3.3.2.2.3 states that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and in which condensation or deliquescence is possible. The SRP-LR also states that the possibility for cracking extends to components exposed to air that has recently been introduced to buildings. The applicant addressed the further evaluation criteria of the SRP-LR by stating that cracking of stainless steel components directly exposed to outdoor air, including indoor components accessible to outdoor air, will be managed by the External Surfaces Monitoring program.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The program includes inspecting for leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides. However, the staff noted that several AMR items associated with item 3.3.1-4 have a gaseous, condensation, or indoor air internal environment. As a result, it was unclear to the staff how inspections of external surfaces will effectively use leakage as an indicator of cracking. By letter dated November 7, 2016, the staff issued RAI B.1.10-4 requesting that the applicant state the parameters inspected and the inspection methods that will be used to determine whether cracking is present on the outdoor components that have a gaseous, condensation, or indoor air internal environment. The staff's evaluation of the applicant's response to RAI B.1.10-4 and followup RAI B.1.10-4a is documented in SER Section 3.0.3.2.6.

In its review of components associated with item 3.3.1-4, 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 program is acceptable because the periodic visual inspections for leakage, as well as other methods and programs (i.e., one-time inspection for the plant stack monitoring instrumentation tubing) described in the applicant's responses to

RAIs B.1.10-4 and B.1.10-4a documented in SER Section 3.0.3.2.6, are capable of identifying cracking prior to loss of intended functions.

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 steel with stainless steel or nickel alloy cladding pump casings exposed to treated borated water. The applicant stated that the charging pump casings are solid stainless steel. The staff confirmed the applicant's statement by reviewing the FSAR and finds that this item would not apply because the pump casings are not steel with stainless steel or nickel alloy cladding, and the solid stainless steel pump casings are not susceptible to boric acid corrosion.

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 stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, which will be managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring program. 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 in which condensation or deliquescence is possible. The SRP-LR also states that the possibility for loss of material extends to components exposed to air that has recently been introduced to buildings. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material of stainless steel components directly exposed to outdoor air, including indoor components accessible to outdoor air, will be managed by the External Surfaces Monitoring program.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The staff noted that the applicant's program includes periodic visual inspections of external surfaces, conducted at least once per refueling cycle, to identify corrosion and any other conditions that preclude the stainless steel from having a clean, shiny surface. In its review of 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 program is acceptable because the periodic visual inspections described above are capable of identifying loss of material prior to loss of intended functions.

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 metallic piping, piping components, and tanks exposed to raw water or waste water. As modified by LR-ISG-2012-02, the criteria in SRP-LR Section 3.3.2.2.8 state that recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. The SRP-LR also states that recurring internal corrosion can be identified by searching plant operating experience for repeated instances in which an aging effect results in a component either not meeting plant-specific criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant addressed the further evaluation criteria by stating that its review of plant operating experience identified recurring internal corrosion in carbon steel piping exposed to raw water and included the associated AMR item in LRA Table 3.3.2-8, "Fire Protection – Water System." The applicant stated that the Fire Water System program will conduct augmented flow tests or flushing and wall thickness measurements at selected locations prior to the period of extended operation and at least once every refueling outage during the period of extended operation. The staff notes that the Fire Water System program includes a specific enhancement to address those portions of the system that have experienced recurring internal corrosion. The staff's evaluation of the enhancement and the overall adequacy of the AMP to address recurring internal corrosion is documented in SER Section 3.0.3.2.9.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

For LRA Tables 3.3.2-1 through 3.3.2-15-36, 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 3.3.2-15-36, 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 Chemical and Volume Control – Summary of Aging Management Review – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the chemical and volume control 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 chemical and volume control component groups are consistent with the GALL Report.

3.3.2.3.2 Chilled Water – 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 chilled water component groups.

Copper Alloy Greater than 15 percent Zinc or 8 percent Aluminum Piping Components Exposed to Condensation. In LRA Table 3.3.2-2, the applicant stated that copper alloy greater than 15-percent-zinc or 8-percent-aluminum piping components exposed to condensation will be managed for loss of material (due to selective leaching) by the Selective Leaching program. The AMR items cite generic note H.

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 (due to general, pitting, and crevice corrosion) for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-2. The GALL Report does not include any AMR items citing materials susceptible to selective leaching exposed to a condensation environment. The staff concluded that there is not sufficient water or duration of exposure on the surface of the component to support loss of material due to selective leaching in a condensation environment. In addition, during its search of plant-specific operating experience, the staff did not detect any evidence of a condensation environment causing loss of material due to selective leaching. However, the applicant included these components based on its evaluation of each material and environment for plant-specific aging effects.

The staff's evaluation of the applicant's Selective Leaching 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 Selective Leaching program acceptable because conducting a one-time inspection of a representative sample of each material and environment combination using visual and mechanical examination techniques is an acceptable means to detect the potential of loss of material due to selective leaching.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). In LRA Tables 3.3.2-2, 3.3.2-15-9, 3.3.2-15-10, and 3.3.2-15-11, the applicant stated that carbon steel and stainless steel closure bolting exposed externally to condensation will be managed for loss of preload by the Bolting Integrity 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 carbon steel and stainless closure bolting exposed to condensation is susceptible to loss of material and recommends GALL Report AMP XI.M18, "Bolting Integrity,"

to manage the aging effect. However, the applicant has identified loss of preload 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 Tables 3.3.2-2, 3.3.2-15-9, 3.3.2-15-10, and 3.3.2-15-11.

The staff's evaluation of the applicant's Bolting Integrity program is documented in SER Section 3.0.3.2.1. The staff finds the applicant's proposal to manage loss of preload using the Bolting Integrity program acceptable because the program includes: (1) periodic visual inspections of closure bolting, which is capable of detecting loss of preload and associated signs of leakage before there is a loss of intended function; and (2) preventive actions such as application of proper lubricant and torque; and checking the uniformity of the gasket compression during bolting assembly to preclude or minimize loss of preload.

Stainless Steel Piping Components Exposed to Condensation (External). In LRA Tables 3.3.2-2, 3.3.2-15-10, and 3.3.2-15-11, the applicant stated that stainless steel piping components and piping elements (flow elements, pump casing, thermowell, tubing, valve bodies, and strainer housing) externally exposed to condensation will be managed for loss of material by the External Surfaces Monitoring 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 stainless steel piping components exposed to condensation are susceptible only to 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 External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," contains guidance for managing loss of material for stainless steel in an outdoor air environment. The applicant has identified the same material and aging effect in a condensation environment: The definition of outdoor air in GALL Report Table IX.D, "Selected Definitions & Use of Terms for Describing and Standardizing Environments" includes the condensation environment.

The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring program acceptable because the periodic visual inspections in the program, which are conducted at least once per refueling cycle, are capable of detecting loss of material and cracking before loss of the intended function.

3.3.2.3.3 Component Cooling and Auxiliary Component Cooling Water – 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 component cooling and ACCW component groups.

Aluminum Heat Exchanger Fins Exposed to Condensation. In LRA Table 3.3.2-3, the applicant stated that aluminum heat exchanger fins exposed to condensation will be managed for cracking and loss of material by the External Surfaces Monitoring program and for reduction of heat transfer by the PSPM 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. The staff noted that the intended function of the heat exchanger fins is limited to heat transfer, such that managing cracking and loss of material will address loose, missing, or detached fins. Based on its review of the GALL Report, which identifies cracking and loss of material as aging effects for aluminum components and reduction in heat transfer due to fouling as an aging effect for heat exchanger components in an outdoor air environment, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination. However, in its response to RAI B.1.10-4a for the External Surfaces Monitoring program (SER Section 3.0.3.2.6), the applicant revised LRA Table 3.3.2-3 by stating that the PSPM program will manage cracking and loss of material for the aluminum heat exchanger fins. This results in all aging effects for the heat exchanger fins being managed by the PSPM program.

The staff's evaluation of the PSPM program is documented in SER Section 3.0.3.3.1. The staff finds the applicant's proposal to manage fouling, loss of material, and cracking, which result in reduction of heat transfer for the heat exchanger fins, using the PSPM program acceptable because the periodic visual inspections conducted by the program, with a representative sample of components inspected at least once every 5 years, are capable of detecting loose, missing, or detached fins and fouling of the heat exchanger fin surfaces prior to loss of intended function.

<u>Carbon Steel Components Exposed to Outdoor Air (Internal)</u>. In LRA Table 3.3.2-3, 3.3.2-7, and 3.4.2-5-6, the applicant stated that carbon steel components (fan housings, blower housings, flame arrestors, and modules) internally exposed to outdoor air will be managed for loss of material by the External Surfaces Monitoring program. The AMR items cite generic note G and plant-specific notes 305 and 404, which state that the aging effects of the internal surfaces can be represented by the external surface conditions because the components have openings that expose the internal surfaces to the same outdoor air environment as the external surfaces.

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 carbon steel components exposed to outdoor air are susceptible to 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 External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," as amended by ISG-2012-02, states that "the program also may be credited with managing loss of material from internal surfaces of metallic components […] for cases in which material and environment combinations are the same for internal and external surfaces such that the external surface condition is representative of the internal surface condition."

The staff finds the applicant's proposal to manage aging using the External Surfaces Monitoring program acceptable because the periodic visual inspections in the program, which are conducted at least once per refueling cycle, are capable of detecting loss of material on the component external surfaces such that degradation of the internal surfaces will be identified before loss of the intended function.

Carbon Steel Heat Exchanger Tubes Exposed to Condensation. In LRA Table 3.3.2-3, the applicant stated that carbon steel heat exchanger tubes exposed to condensation will be managed for reduction of heat transfer due to fouling by the PSPM program. The AMR item cites 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. For the subject heat exchanger tubes, the applicant addressed loss of material in other AMR items. Therefore, 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 PSPM program is documented in SER Section 3.0.3.3.1. The staff finds the applicant's proposal to manage aging using this program acceptable because the periodic visual inspections conducted by the program, with a representative sample of components inspected at least once every 5 years, are capable of detecting fouling of the heat exchanger tube surfaces prior to loss of the intended function.

EPDM Flex Hoses Exposed to Raw Water. In LRA Table 3.3.2-3, as modified by letter dated February 23, 2017, the applicant stated that flex hoses made from ethylene propylene diene monomer (EPDM) exposed to raw water have no AERM and proposed no AMP. The AMR items cite generic note F, indicating that this material is not in the GALL Report for this component.

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 ASM Engineered Materials Handbook Desk Edition, "Elastomer Structures, Properties, and Applications," which states that EPDM is considered an age-resistant elastomer with excellent resistance to water; good to excellent abrasion resistance; and continuous-use service temperatures (-70 °F to 300 °F) well within the operating range of the wet cooling tower basins.

3.3.2.3.4 Compressed Air – 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 compressed air component groups.

Elastomeric Flex Hose Exposed to Condensation (Internal). In LRA Table 3.3.2-4, the applicant stated that for elastomeric flex hoses exposed to condensation (internal) there is no aging effect and no AMP is proposed. The AMR item cites generic note G.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environment combination. The staff noted that loss of material due to wear is being managed for the external surfaces of the flex hoses by the External Surfaces Monitoring program. The staff also noted that the External Surfaces Monitoring program includes periodic visual inspections augmented by mechanical manipulation of elastomeric surfaces. GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," allows monitoring of the internal surfaces of components where the material and environment is the same for the internal and external surfaces such that the external surface is representative of the internal surface condition. The GALL Report recommends that hardening and loss of strength of elastomeric components be managed by GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting

Components," for environments such as treated water, closed-cycle cooling water, and air environments (e.g., AP-101, AP-259, LP-29). Although the applicant cited no aging effect, the staff finds the applicant's proposal that there is no associated AMP for these elastomeric flex hoses exposed to condensation (internal) acceptable because the air-indoor environment and condensation environment are similar enough to credit the applicant's External Surfaces Monitoring program. The staff finds the applicant's External Surfaces Monitoring program acceptable because it conducts periodic visual examinations with physical manipulation of elastomers that can detect hardening, loss of strength, and loss of material due to wear on the inside and outside surfaces of these components.

Plastic Piping Components Exposed to Condensation (Internal) and Indoor Air (External). In LRA Table 3.3.2-4, the applicant stated that for plastic regulator bodies and filter bodies exposed to condensation (internal) and indoor air (external) there is no aging effect and no AMP is proposed. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environment combination. During the audit, the staff interviewed the applicant. The applicant stated that it could not determine the components' plastic material type. They also stated that the components are located in the main control room and are portions of the compressed air system interface with the breathing air system. The staff noted that plastics in general are susceptible to degradation due to exposure to environmental factors such as temperature, radiation, ozone, sunlight, oxidation, and ultraviolet light (GALL Report Chapter IX.E, "Use of Terms for Aging"). By letter dated November 7, 2016, the staff issued RAI 3.3.2.3.4-1 requesting that the applicant confirm the portion of the air system in which the regulators and filters are installed and the location of the components. In addition, the staff requested that the applicant state the basis for why environmental factors, including temperature, radiation, ozone, sunlight, oxidation, and ultraviolet light will not cause degradation of the components.

In its response dated December 7, 2016, the applicant stated that the regulator bodies and filter housings are: (a) installed in seven locations in the control room, (b) not subject to abnormal conditions, and (c) exposed to florescent lighting. The applicant stated that change in material properties would be managed for these components because the specific type of plastic could not be confirmed. LRA Table 3.3.2-4 was revised to credit the External Surfaces Monitoring program to manage change in material properties for these components.

The staff's evaluation of the External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The staff noted that the External Surfaces Monitoring program includes periodic visual inspections. The staff also noted that the control room environment would not result in exposure to temperature, radiation, ozone, sunlight, and oxidation; however, as the applicant stated, exposure to florescent lighting could occur. The staff finds the applicant's response and proposal acceptable because the visual inspections can be capable of detecting surface cracking and discoloration that are indicative of change in material properties. The staff's concern described in RAI 3.3.2.3.4-1 is resolved.

3.3.2.3.5 Containment Cooling HVAC – 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 containment cooling HVAC component groups.

Aluminum, Copper Alloy, and Copper Alloy with Greater than 15 Percent Zinc (Inhibited) Heat Exchanger Fins and Tubes Exposed to Indoor Air and Condensation. In LRA Tables 3.3.2-5, 3.3.2-6, 3.3.2-7, and 3.3.2-12, the applicant stated that aluminum, copper alloy, and copper alloy with greater than 15 percent zinc (inhibited) heat exchanger fins and tubes exposed to indoor air and condensation will be managed for fouling by the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR items cite generic note G or H.

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 combination. For the subject heat exchanger fins and tubes, the applicant addressed loss of material in other AMR items with the exception of the aluminum heat exchanger fins exposed to indoor air in the EDG system. However, loss of material is not expected to occur for this combination of material and environment. Therefore, 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 Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.6. The staff finds the applicant's proposal to manage aging using the 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 inspected at least once every 10 years, are capable of detecting fouling of the heat exchanger surfaces prior to loss of the intended function.

3.3.2.3.6 Control Room HVAC – 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 control room HVAC component groups.

Copper Alloy Heat Exchanger Fins and Tubes Exposed to Condensation. The staff's evaluation for copper-alloy heat exchanger fins and tubes exposed to condensation, which will be managed for fouling by the Internal Surfaces in Miscellaneous Piping and Ducting Component program and are associated with generic note H, is documented in Section 3.3.2.3.5.

3.3.2.3.7 Emergency Diesel Generator – 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 EDG component groups.

Aluminum and Copper Alloy with Greater than 15 Percent Zinc (Inhibited) Heat Exchanger Fins and Tubes Exposed to Indoor Air. The staff's evaluation for aluminum and copper alloy with greater than 15 percent zinc (inhibited) heat exchanger fins and tubes exposed to indoor air, which will be managed for fouling by the Internal Surfaces in Miscellaneous Piping and Ducting Component program and are associated with generic note G, is documented in Section 3.3.2.3.5.

Carbon Steel Components Exposed to Outdoor Air (Internal). The staff's evaluation for the carbon steel flame arrestors internally exposed to outdoor air, which will be managed for loss of

material by the External Surfaces Monitoring program and are associated with generic note G and plant-specific note 305, is documented in SER Section 3.3.2.3.3.

Carbon Steel Piping Exposed to Exhaust Gas (int). In LRA Tables 3.3.2-7, 3.3.2-8, and 3.3.2-13, the applicant stated that there is a TLAA for carbon steel piping exposed to exhaust gas (int), which cites generic notes G and H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for carbon steel piping is documented in SER Section 4.3.

Carbon Steel Tank Exposed to Concrete (External). In LRA Table 3.3.2-7, the applicant stated that for carbon steel tanks externally exposed to concrete, there is no aging effect and no AMP is proposed. The AMR item cites generic note G and plant-specific note 304, which states that the tank is located indoors and is seated on, not embedded in, concrete.

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 noted that the tank is also exposed to air-indoor, which is defined in LRA Table 3.0-1 as air with steam or water leakage, and as discussed in LR-ISG-2012-02, corrosion can occur if moisture penetrates the interface between indoor tanks and the concrete surface on which they sit. Consequently, it was not clear to the staff that the tank-concrete interface would remain dry, such that corrosion would not be expected.

By letter dated February 14, 2017, the staff issued RAI 3.3.2.7-2 requesting that the applicant describe the tank support configuration and confirm that no water sources are near the tank. In its response dated March 16, 2017, the applicant stated that the bottoms of the tanks are approximately 2 ft. above the floor and resting on reinforced concrete pedestals with a grout seal between the pedestals and outer perimeters of the tanks. The applicant further stated that the room sump pump prevents water accumulation to a level that could reach the base of the tank. In addition, the applicant confirmed that there are no potential water sources near the tank and, based on a plant-specific operating experience search, did not find instances where water leaked onto the tank or reached the elevated tank-concrete interface.

The staff finds both the applicant's response to RAI 3.3.2.7-2 and its proposal regarding no AERM acceptable because the tank support configuration, when combined with the lack of potential water sources and the room sump system, provides reasonable assurance that water accumulation in the room will not reach the tank bottom to cause significant corrosion. The staff's concern described in RAI 3.3.2.7-2 is resolved.

Internally Coated Carbon Steel Tanks and Heat Exchangers Exposed to Fuel Oil. In LRA Table 3.3.2-7, the applicant stated that internally coated carbon steel tanks and heat exchangers exposed to fuel oil will be managed for loss of material by the Coating Integrity 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. 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 3.3.2-7. 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," issued the new AMP XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." The "scope of program" program

element for this AMP states: "[f]or components where the aging effects of internally coated/lined surfaces are managed by this program, loss of material and loss of material due to selective leaching need not be managed for these components by another program." Based on its review of AMP XI.M42, 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 Coating Integrity program is documented in SER Section 3.0.3.2.2. The staff finds the applicant's proposal to manage the effects of aging using the Coating Integrity program acceptable because periodic visual inspections by qualified personnel are capable of detecting loss of coating integrity. If degraded coatings are noted, the program includes acceptance criterion for loss of wall thickness and corrective actions to restore the coating.

<u>Stainless Steel Expansion Joint Exposed to Air – Indoor (int)</u>. In LRA Table 3.3.2-7, the applicant stated that there is a TLAA for stainless steel expansion joint exposed to air – indoor (int), which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for stainless steel expansion joint is documented in SER Section 4.3.

<u>Stainless Steel Expansion Joint Exposed to Exhaust Gas (int)</u>. In LRA Table 3.3.2-7, the applicant stated that there is a TLAA for stainless steel expansion joint exposed to exhaust gas (int), which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for stainless steel expansion joint is documented in SER Section 4.3.

<u>Stainless Steel Heat Exchanger Tubes Externally Exposed to Fuel Oil</u>. In LRA Table 3.3.2-7, the applicant stated that stainless steel heat exchanger tubes externally exposed to fuel oil will be managed for reduction of heat transfer by the Diesel Fuel Monitoring program. The AMR item cites 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. The staff noted that the applicant addressed cracking, loss of material, and loss of material due to wear for this component, material, and environment combination in other AMR items in LRA Table 3.3.2-7. Based on its review of GALL Report Chapter IX, Table IX.C, which states that stainless steel is susceptible to a variety of aging effects and mechanisms, including loss of material due to pitting and crevice corrosion, and cracking due to SCC, the staff finds that the applicant has identified all credible aging effects for this component, material, and environment combination.

The applicant has identified reduction of heat transfer as an additional aging effect. However, GALL Report AMP XI.M30 only manages loss of material and does not include reduction of heat transfer. In addition, the item does not include the plant-specific note for using the One-Time Inspection program to verify the effectiveness of the Diesel Fuel Monitoring program specifically for reduction of heat transfer. Although the effectiveness of the program is being verified using the One-Time Inspection program for cracking, loss of material, and loss of material due to wear, it is unclear to the staff whether the effectiveness of the program will be verified for reduction of heat transfer. By letter dated November 7, 2016, the staff issued RAI 3.3.2.7-1 requesting that the applicant provide a technical basis to demonstrate that the Diesel Fuel Monitoring program will be effective in managing reduction of heat transfer for the heat exchanger tubes. Additionally, the applicant was requested to confirm that the One-Time

Inspection program will be used to verify the effectiveness of the Diesel Fuel Monitoring program for managing reduction of heat transfer or provide a basis for not needing this verification.

In its response dated December 7, 2016, the applicant stated that the Diesel Fuel Monitoring program activities that manage fouling also manage the aging effect of reduction of heat transfer. Additionally, the One-Time Inspection program will be used to verify the effectiveness of the Diesel Fuel Monitoring program for managing reduction of heat transfer.

The staff finds the applicant's response acceptable because the program will manage the reduction of heat transfer for the stainless steel heat exchangers tubes externally exposed to fuel oil. Additionally, the effectiveness of the Diesel Fuel Monitoring program will be verified by the One-Time Inspection program, which is consistent with the GALL Report. The staff's concern described in RAI 3.3.2.1-7 is resolved.

The staff's evaluation of the applicant's Diesel Fuel Monitoring program is documented in SER Section 3.0.3.2.5. The staff finds the applicant's proposal to manage the effects of aging using the Diesel Fuel Monitoring program and the One-Time Inspection program acceptable because when implemented it will be consistent with the GALL Report.

<u>Stainless Steel Heat Exchanger Tubes Exposed to Fuel Oil, Lubricating Oil, and Treated Water</u>. In LRA Table 3.3.2-7, the applicant stated that the external surfaces of stainless steel heat exchanger tubes exposed to fuel oil, lubricating oil, and treated water will be managed for loss of material due to wear by the PSPM program. The AMR items cite generic notes G or H.

The staff noted that this material and environment combination is identified in the GALL Report, which states that stainless steel heat exchanger tubes exposed to fuel oil, lubricating oil, and treated water are susceptible to loss of material and fouling and recommends GALL Report AMPs XI.M30, "Fuel Oil Chemistry," XI.M39, "Lubricating Oil Analysis," and XI.M21A, "Closed Treated Water Systems," respectively, to manage the 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 3.3.2-7. However, the applicant has identified loss of material due to wear as an additional aging effect.

During its review, the staff noted that because access to the external surfaces of heat exchanger tubes is typically very limited due to tube spacing, tube supports, etc., it was unclear to the staff whether the visual inspection being proposed by the PSPM program of the tubes' external surfaces could be reasonably expected to detect loss of material due to wear. By letter dated October 12, 2016, the staff issued RAI B.1.30-4 requesting that the applicant justify the adequacy of the visual inspection in the PSPM program to detect loss of material due to wear for EDG cooler heat exchanger tubes.

The staff's evaluation of the applicant's response to RAI B.1.30-4 is documented in SER Section 3.0.3.3.1, which noted that eddy current testing of a representative sample would be used in lieu of visual inspections to detect loss of material due to wear. The staff finds the applicant's proposal to manage aging using the PSPM program acceptable because eddy current testing, with a representative sample of tubes inspected at least once every 5 years, is capable of detecting loss of material due to wear of the heat exchanger tubes prior to loss of the intended function.

Stainless Steel Piping Exposed to Outdoor Air. As amended by letter dated November 15, 2017, LRA Table 3.3.2-7 states that stainless steel piping exposed to outdoor air (internal) will be managed for loss of material and cracking by the 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 combination. During its review of the GALL Report, the staff noted that stainless steel exposed to outdoor air is susceptible to loss of material and cracking. Therefore, 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 Internal Surfaces in Miscellaneous Piping and Ducting Components program is documented in SER Section 3.0.3.1.6. During its review of the GALL Report, the staff noted that the internal surfaces of stainless piping can be managed for loss of material (item VII.E5.AP-273 for condensation) and cracking (item VII.H2.AP-128 for diesel exhaust) using the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The staff finds the applicant's proposal to manage aging using the 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 inspected at least once every 10 years, are capable of detecting loss of material and cracking prior to loss of the intended function.

In addition, the staff noted the following during its review of the subject letter: (a) the external surfaces of this piping are being managed for cracking using the External Surfaces Monitoring program, which uses leakage as an indicator of cracking, and (b) the internal and external surfaces of this piping are both exposed to outdoor air. Although the staff does not agree with using leakage as an indicator of external surface cracking for components with a non-aqueous internal environment (except as documented in the staff's evaluation of the "parameters monitored or inspected" program element in SER Section 3.0.3.2.6), the staff finds the applicant's proposal to manage the external surfaces of this piping for cracking acceptable because (a) the internal surfaces are being managed for cracking using the Internal Surfaces in Miscellaneous Piping and Ducting Components program, and (b) the material and environment combinations are the same for internal and external surfaces such that internal surface condition is representative of external surface condition.

3.3.2.3.8 Fire Protection – Water – 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 fire protection – water component groups.

Carbon Steel with Internal Coating Tank Exposed to Raw Water. In LRA Table 3.3.2-8, the applicant stated that carbon steel tanks with internal coatings exposed to raw water will be managed for loss of coating integrity by the Fire Water System 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 internally coated steel components exposed to raw water are susceptible to loss of coating integrity and recommends Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," to manage the aging

effect. However, the "scope of program" program element of AMP XI.M42 allows an applicant to manage loss of coating integrity with an alternative program, as long as the recommendations of AMP XI.M42 are included in the alternative program and the FSAR supplement for the alternative program includes the applicable details from SRP-LR Table 3.0-1, "FSAR Supplement for Aging Management of Applicable Systems."

The staff's evaluation of the applicant's Fire Water System program is documented in SER Section 3.0.3.2.9. The staff noted: (a) Enhancement 6 of the program addresses followup inspections of the coatings when coating degradation is noted, (b) Enhancement 17 of the program addresses qualifications of coating inspectors, (c) Enhancement 18 addresses wet sponge and dry film thickness testing of coatings, (d) Enhancement 20 addresses alternative actions if a fire water storage tank is returned to service with degraded coatings, (e) Enhancement 21 addresses followup testing of degraded coatings, and (f) Enhancement 22 addresses the acceptance criteria for coatings. The staff finds the applicant's proposal to manage loss of coating integrity for the inside surfaces of the fire water storage tanks using the Fire Water System program acceptable because: (a) the program's periodic inspections of the internal coatings of the fire water storage tank are capable of detecting loss of coating integrity, (b) the program has been enhanced to address all applicable portions of the recommendations of AMP XI.M42, and (c) the FSAR supplement for the Fire Water System program is consistent with the SRP Table 3.0-1 for AMP XI.M42.

<u>PVC Piping Exposed to Soil (External) and Raw Water (Internal)</u>. In LRA Table 3.3.2-8, the applicant stated that for polyvinyl chloride (PVC) piping exposed to soil (external) and raw water (internal) there is no aging effect and no AMP is proposed. The AMR item cites generic note G.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environment combination. During the audit, the staff confirmed that the PVC piping is embedded in controlled low strength material (CLSM) cementitious material. FSAR Section 9.5.1.2.2 B.1 states: "The tanks [fire water storage tanks] are filled directly from the potable water system or by pumps drawing suction from the primary water treatment system clear well, which is supplied with either filtered Mississippi River water or Parish water." The staff finds the applicant's proposal acceptable based on its review of "PVC Degradation and Stabilization," by George Wypych, ChemTec Publishing, 2008; and "Advances in Polymer Nanocomposites – Types and Applications," by Fengge Gao, Woodhead Publishing, 2012; and because buried PVC is not susceptible to thermal, UV, or radiation related degradation. In addition, based on the sources of makeup for the fire water system, PVC is not susceptible to chemical degradation. Although PVC is susceptible to mechanical wear due to ground movement of deleterious materials in soil backfill because of soil temperature changes, loss of material due to wear is not applicable when the PVC pipe is embedded in CLSM. This is reinforced by the recommendation in AMP XI.M41, "Buried and Underground Piping and Tanks," which states: "[n]o inspections are necessary if all the piping constructed from a specific material type is fully backfilled using CLSM for: (a) polymeric and cementitious materials…"

3.3.2.3.9 Fire Protection RCP Oil Collection – 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 fire protection RCP oil collection component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type,

material, environment, and AERM for the fire protection RCP oil collection component groups are consistent with the GALL Report.

3.3.2.3.10 Fuel Pool Cooling and Purification – 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 fuel pool cooling and purification component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for the fuel pool cooling and purification component groups are consistent with the GALL Report.

3.3.2.3.11 Nitrogen – 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 nitrogen component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for the nitrogen component groups are consistent with the GALL Report.

3.3.2.3.12 Miscellaneous HVAC – 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 miscellaneous HVAC component groups.

Copper Alloy Heat Exchanger Fins and Tubes Exposed to Condensation. The staff's evaluation for copper-alloy heat exchanger fins and tubes exposed to condensation, which will be managed for fouling by the Internal Surfaces in Miscellaneous Piping and Ducting Component program and are associated with generic note G, is documented in Section 3.3.2.3.5.

3.3.2.3.13 Auxiliary Diesel Generator – 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 auxiliary diesel generator component groups.

Aluminum Flame Arrestors Exposed to Outdoor Air (ext and int). In LRA Table 3.3.2-13, the applicant stated that aluminum flame arrestors exposed to outdoor air (externally and internally) will be managed for cracking by the External Surfaces Monitoring 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 aluminum piping, piping components, and piping elements exposed to outdoor air are susceptible to loss of material due to pitting and crevice corrosion and recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." 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 3.3.2-13.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. During its review, the staff noted that methods for detecting cracking in aluminum components are not specified in the External Surfaces Monitoring program. In its responses to RAIs B.1.10-4 and B.1.10-4a for the External Surfaces Monitoring program, the applicant revised LRA Table 3.3.2-2 by stating that the item for cracking of the aluminum flame arrestor is removed from the LRA because the 3xxx series alloy is not susceptible to SCC. The staff's evaluations of the applicant's responses to RAIs B.1.10-4 and B.1.10-4a are documented in SER Section 3.0.3.2.6.

The staff finds the applicant's proposal to not manage cracking acceptable because the aluminum alloy cited by the applicant is not susceptible to SCC.

Aluminum Flame Arrestors Exposed to Outdoor Air (int). As amended by letter dated February 1, 2017, LRA Table 3.3.2-13 states that aluminum flame arrestors exposed to outdoor air (internal) will be managed for loss of material by the External Surfaces Monitoring program. The AMR item cites generic note G.

The staff noted that this material and environment combination is identified in the GALL Report, which states that aluminum piping, piping components, and piping elements exposed to outdoor air are susceptible to loss of material due to pitting and crevice corrosion and recommends GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." The staff finds the applicant's proposal to manage loss of material using the External Surfaces Monitoring program acceptable because it is consistent with GALL Report recommendations.

Carbon Steel Components Exposed to Outdoor Air (Internal). As amended by letter dated February 1, 2017, the applicant revised the material section of this AMR item to state carbon steel instead of gray cast iron. The staff's evaluation for the carbon steel flame arrestors internally exposed to outdoor air, which will be managed for loss of material by the External Surfaces Monitoring program and are associated with generic note G and plant-specific note 305, is documented in SER Section 3.3.2.3.3.

3.3.2.3.14 Plant Drains – 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 plant drains component groups. The staff's review did not identify any AMR items with notes F through J, indicating that all of the listed combinations of component type, material, environment, and AERM for the plant drains component groups are consistent with the GALL Report.

3.3.2.3.15 Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Review – LRA Tables 3.3.2-15-1 through 3.3.2-15-36

The staff reviewed LRA Tables 3.3.2-15-1 through 3.3.2-15-36, which summarize the results of AMR evaluations for the auxiliary systems in scope for 10 CFR 54.4(a)(2) component groups.

Aluminum Filter Housing Exposed to Waste Water. In LRA Table 3.3.2-15-29, the applicant stated that aluminum filter housings exposed internally to waste water will be managed for loss of material by the Internal Surfaces in Miscellaneous Piping and Ducting Components program. The AMR item cites generic note G.

The staff reviewed the associated item in the LRA and considered whether the aging effect proposed by the applicant constitutes all of the credible aging effects for this component, material, and environment description. During its review, the staff noted that (1) cracking due to SCC is known to occur in high and moderate strength aluminum alloys, (2) halide concentrations should generally be considered high enough to facilitate cracking due to SCC of aluminum alloys in waste water unless demonstrated otherwise, and (3) depending on the specific aluminum alloy used for the filter housings, the aging effect of cracking due to SCC may or may not be applicable. By letter dated October 12, 2016, the staff issued RAI 3.3.2.3.15.29-1 requesting that the applicant state the basis for why cracking due to SCC is not an applicable aging effect for aluminum filter housings exposed to waste water.

In its response dated January 9, 2017, the applicant stated that based on further review of available documentation and consultation with the equipment supplier, the filter housings are constructed of stainless steel, which is appropriately shown in LRA Table 3.3.2-15-29. The applicant also deleted the material type of aluminum from LRA Section 3.3.2.1.15 and items for aluminum filter housings from LRA Table 3.3.2-15-29. The staff finds the applicant's response acceptable because the aluminum filter housings exposed to waste water were removed from the LRA, making the staff's concern described in RAI 3.3.2.3.15.29-1 no longer relevant.

Carbon Steel and Stainless Steel Closure Bolting Exposed to Condensation (External). In LRA Tables 3.3.2-15-9, 3.3.2-15-10, and 3.3.2-15-11, the applicant stated that carbon steel and stainless steel closure bolting exposed externally to condensation will be managed for loss of preload by the Bolting Integrity program and is associated with generic note H. The staff's evaluation for these items is documented in SER Section 3.3.2.3.2.

Carbon Steel Closure Bolting Exposed to Waste Water (External). In LRA Table 3.3.2-14, the applicant stated that carbon steel closure bolting exposed externally to waste water will be managed for loss of material and loss of preload by the Bolting Integrity 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. The staff notes that the GALL Report defines a waste water environment as potentially radioactive or nonradioactive waters that are collected from equipment and floor drains. Based on its review of the GALL Report, which states that steel piping components exposed to waste water and bolted connections exposed to borated water leakage should be managed for loss of material and that steel closure bolts (not made of high-strength steel) exposed to any environment should be managed for loss of preload, 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 Bolting Integrity program is documented in SER Section 3.0.3.2.1. The staff notes that GALL Report AMP XI.M18, "Bolting Integrity," recommends periodic inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation due to loss of material and loss of preload. The staff noted that a submerged environment limits the ability to detect leakage of submerged bolted connections; therefore, it was not clear how the program will detect loss of material and loss of preload prior to a loss of intended function. Therefore, by letters dated September 15, 2016, and November 15, 2016, the staff issued RAIs B.1.1-1 and B.1.1-1a, respectively, requesting that the applicant provide its technical basis to demonstrate that the program's method(s) and frequency of inspections will ensure that the applicable aging effects

will be adequately managed before there is a loss of intended function. Based on its review of information provided by letters dated October 13, 2016, and December 15, 2016, regarding the applicant's responses to RAIs B.1.1-1 and B.1.1-1a and revisions to LRA Sections A.1.1 and B.1.1, the staff noted that the Bolting Integrity program proposes to manage the aging effect of loss of material and loss of preload for closure bolting submerged in waste water by:

- performing opportunistic inspection of the normally inaccessible submerged bolting on the DCT area sump pumps
- performing a flow-test for each of the DCT area sump pumps at least once every 7 years and entering any degradation detected during the flow test in the corrective action program for further investigation
- performing inspections of the two DCT area sumps every shift by the operations personnel
- monitoring sump levels in the control room, an alarm will alert operators in the control room if the DCT area sump pumps are not maintaining acceptable levels

This issue is resolved and documented in SER Section 3.0.3.2.1.

The staff finds the applicant's proposal to manage loss of material and loss of preload for closure bolts submerged in waste water using the Bolting Integrity program acceptable because the combination of the activities described above are able to detect and adequately manage these aging effects prior to a loss of intended function.

<u>Carbon Steel Traps, Valve Bodies, and Piping Exposed to Steam</u>. In LRA Table 3.3.2-15-4, the applicant stated that carbon steel traps, valve bodies, and piping exposed to steam will be managed for loss of material by the Water Chemistry Control – Primary and Secondary program. However, in LRA Table 3.4.1, item 3.4.1-14 (associated Table 1 item), the applicant stated that carbon steel piping, piping components, and piping elements exposed to steam will be managed for loss of material using the Water Chemistry Control – Primary and Secondary program and One-Time Inspection program. By letter dated October 12, 2016, the staff issued RAI 3.3.2.3.15.4-1 requesting that the applicant reconcile the apparent discrepancy regarding the program(s) managing loss of material of carbon steel traps, valve bodies, and piping exposed to steam and to update the LRA as appropriate.

In its response dated November 10, 2016, the applicant revised LRA Table 3.3.2-15-4 to cite generic note 301 for the subject carbon steel traps, valve bodies, and piping exposed to steam. Generic note 301 states that "[t]he One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – Primary and Secondary Program." In addition, based on further review of the LRA, the applicant revised LRA Table 3.3.2-15-28 to cite generic note 301 for stainless steel flex hoses, piping, traps, valve bodies, and vessel exposed to treated borated water >140°F where cracking will be managed using the Water Chemistry Control – Primary and Secondary program. The staff finds the applicant's proposal to manage loss of material of the subject carbon steel components and cracking of the subject stainless steel components using the Water Chemistry Control – Primary and Secondary program and One-Time Inspection program acceptable because it is consistent with GALL Report recommendations.

<u>Plastic Piping Exposed to Condensation (External) and Treated Water (Internal)</u>. In LRA Table 3.3.2-15-11, the applicant stated that for plastic piping exposed to condensation (external)

and treated water (internal) there is no aging effect and no AMP is proposed. The AMR item cites generic note F.

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material, and environment combination. During the audit, the staff confirmed that the plastic piping exposed to condensation (external) and treated water (internal) is constructed of PVC material and located inside the plant with no exposure to sunlight. The staff finds the applicant's proposal acceptable based on its review of "PVC Degradation and Stabilization," by George Wypych, ChemTec Publishing, 2008; and "Advances in Polymer Nanocomposites – Types and Applications," by Fengge Gao, Woodhead Publishing, 2012; and indoor PVC is not susceptible to ultraviolet- or radiation-related degradation. In addition, based on the environments of condensation and treated water, PVC is not susceptible to chemical degradation.

Stainless Steel Flow Element, Nozzle, Orifice, Piping, Thermowell, Tubing, and Valve Body Exposed to Steam (int). In LRA Tables 3.3.2-15-4, 3.3.2-15-33, 3.4.2-3, 3.4.2-4, and 3.4.2-15-6, the applicant stated that there is a TLAA for stainless steel flow element, nozzle, orifice, piping, thermowell, tubing, and valve body exposed to steam (int), which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for stainless steel components is documented in SER Section 4.3.

Stainless Steel Piping Components Exposed to Condensation (External). In LRA Tables 3.3.2-15-10 and 3.3.2-15-11, the applicant stated that stainless steel piping components (flow element, strainer housings, tubing, and valve body) externally exposed to condensation will be managed for loss of material by the External Surfaces Monitoring program and are associated with generic note G. The staff's evaluation for these items is documented in SER Section 3.3.2.3.2.

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components of the following:

- Condensate Makeup and Storage
- Emergency Feedwater
- Main Feedwater
- Main Steam
- Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides the AMR results for the steam and power conversion systems components and component groups. LRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included CRs 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 WF3 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	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	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 to WF3	Not Applicable to WF3
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	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 to WF3	Not Applicable to WF3
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	Bolting Integrity	Consistent with the GALL Report
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

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 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 used	Not used (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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	Consistent with the GALL Report
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	Not applicable to WF3	Not applicable to WF3

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, 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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	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 to WF3	Not applicable to WF3
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	Water Chemistry Control – Primary and Secondary and One-Time Inspection	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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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, 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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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, 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 to WF3	Not Applicable to WF3
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	Not applicable to WF3	Not Applicable to WF3
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 to WF3	Not applicable to WF3
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	Selective Leaching	Consistent with the GALL Report
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	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
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	Not applicable to WF3	Not applicable to WF3
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	Internal Surfaces in Miscellaneous Piping and Ducting Components	Consistent with the GALL Report
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	Not applicable to WF3	Not applicable to WF3
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 to WF3	Not applicable to WF3
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 to WF3	Not applicable to WF3
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	Oil Analysis and One-Time Inspection	Consistent with the GALL Report
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	Oil Analysis and One-Time Inspection	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3

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 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 to WF3	Not Applicable to WF3
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	Oil Analysis and One-Time Inspection	Consistent with the GALL Report
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 to WF3	Not applicable to WF3
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	Oil Analysis and One-Time Inspection	Consistent with the GALL Report
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	Not applicable to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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 stainless steel, nickel alloy, steel piping, piping components, and piping elements (3.4.1-50.5)	Loss of material due to general (steel only), pitting and crevice corrosion	Chapter XI.M41, "Buried and Underground Piping and Tanks"	No	Not applicable to WF3	Not Applicable to WF3
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 to WF3	Not applicable to WF3
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 to WF3	Not applicable to WF3
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 to WF3	Not Applicable to WF3
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	Not applicable to WF3	Not Applicable to WF3

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 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 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 to WF3	Not applicable to WF3
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 to WF3	Not applicable to WF3
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 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 to WF3	Not applicable to WF3
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	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 (3.4.1-61)	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 to WF3	Not Applicable to WF3 (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	Not applicable to WF3	Not Applicable to WF3
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	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	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	Not applicable to WF3	Not applicable to WF3
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 applicable to WF3	Not applicable to WF3

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 (3.4.1-67)	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 applicable to WF3	Not applicable to WF3
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 applicable to WF3	Not applicable to WF3

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – Primary and Secondary
- Oil Analysis

LRA Tables 3.4.2-1 through 3.4.2-5-6 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, 3.4.1-6, 3.4.1-15, 3.4.1-17, 3.4.1-19 through 3.4.1-32, 3.4.1-35, 3.4.1-37 through 3.4.1-39, 3.4.1-42, 3.4.1-43, 3.4.1-45, 3.4.1-47 through 3.4.1-54, 3.4.1-56, 3.4.1-57, 3.4.1-59, 3.4.1-62, and 3.4.1-65 through 3.4.1-68, 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 WF3. The staff reviewed the LRA and FSAR and confirmed that the applicant's LRA does not have any AMR results applicable for these items.

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 it did not use item 3.4.1-9 because: (1) this component group is assigned to LRA Table 3.4.1, item 3.4.1-8, which addresses, under the Bolting Integrity AMP, loss of material of steel bolting exposed to an air environment; and (2) the applicant did not consider steam or water leakage to be a separate aspect of the air indoor environment. The staff reviewed LRA Section 3.4 and confirmed that the applicant used item 3.4.1-8 for the component group associated with item 3.4.1-9. The staff evaluated the applicant’s claim and finds it acceptable because the applicant evaluated and addressed the AERM for steel closure bolting exposed to air with steam or water leakage with LRA Table 3.4.1, item 3.4.1-8, which manages loss of material under the Bolting Integrity program, and this is consistent with the GALL Report.

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, associated with LRA Table 3.4.1, item 3.4.1-1, states that the effects of cumulative fatigue damage due to fatigue of steel piping, piping components, and piping elements exposed to steam or treated water will be evaluated as a TLAA. The LRA further states that TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of these TLAAs are addressed in LRA Section 4.3. This is consistent with SRP-LR Section 3.4.2.2.1 and is, therefore, acceptable. The staff’s evaluation of these TLAAs 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 stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, which will be managed for cracking due to SCC by the External Surfaces Monitoring program. The criteria in SRP-LR Section 3.4.2.2.2 states that cracking could occur for stainless steel components exposed to outdoor air environments containing sufficient halides and in which condensation or

deliquescence is possible. The SRP-LR also states that the possibility for cracking extends to components exposed to air that has recently been introduced to buildings. The applicant addressed the further evaluation criteria of the SRP-LR by stating that cracking of stainless steel components directly exposed to outdoor air, including indoor components accessible to outdoor air, will be managed by the External Surfaces Monitoring program.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The staff noted that the subject components have an internal environment of treated water, lubricating oil, or steam. The staff also noted that the applicant's program includes periodic visual inspections of external surfaces, conducted at least once per refueling cycle, to identify leakage that would be indicative of cracking. In its review of components associated with item 3.4.1-2, 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 program is acceptable because the periodic visual inspections for leakage described above are capable of identifying cracking prior to loss of intended functions.

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 stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, which will be managed for loss of material due to pitting and crevice corrosion by the External Surfaces Monitoring program. 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 in which condensation or deliquescence is possible. The SRP-LR also states that the possibility for loss of material extends to components exposed to air that has recently been introduced to buildings. The applicant addressed the further evaluation criteria of the SRP-LR by stating that loss of material of stainless steel components directly exposed to outdoor air, including indoor components accessible to outdoor air, will be managed by the External Surfaces Monitoring program.

The staff's evaluation of the applicant's External Surfaces Monitoring program is documented in SER Section 3.0.3.2.6. The staff noted that the applicant's program includes periodic visual inspections of external surfaces, conducted at least once per refueling cycle, to identify corrosion and any other conditions that preclude the stainless steel from having a clean, shiny surface. In its review of components associated with item 3.4.1-3, 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 program is acceptable because the periodic visual inspections described above are capable of identifying loss of material prior to loss of intended functions.

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 metallic piping, piping components, and tanks exposed to raw water or waste water. As modified by LR-ISG-2012-02, the criteria in SRP-LR Section 3.4.2.2.6 state that recurring internal corrosion can result in the need to augment AMPs beyond the recommendations in the GALL Report. The SRP-LR also states that recurring internal corrosion can be identified by searching plant operating experience for repeated instances where an aging effect results in a component either not meeting plant-specific criteria or experiencing a reduction in wall thickness greater than 50 percent. The applicant stated it did not identify any conditions of recurring internal corrosion in the steam and power conversion systems within the scope of license renewal during its review of 10 years of plant operating experience. The staff evaluated the applicant's claim and finds it acceptable because the staff's independent review of plant operating experience during its onsite audit of the applicant's AMPs did not identify conditions in the steam and power conversion systems that met the further evaluation criteria in the SRP-LR that could result in the need to augment the AMPs.

3.4.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-5-6, 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 3.4.2-5-6, 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 Makeup and Storage – 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. 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 condensate system component groups are consistent with the GALL Report.

3.4.2.3.2 Emergency Feedwater – 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 emergency feedwater 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 emergency feedwater component groups are consistent with the GALL Report.

3.4.2.3.3 Main 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 condensate system component groups.

High Strength Steel Closure Bolting Exposed to Air Outdoor (External). In LRA Tables 3.4.2-3 and 3.4.2-4, the applicant stated that high-strength steel closure bolting exposed externally to air outdoor will be managed for cracking by the Bolting Integrity 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. The staff noted that the applicant addressed loss of material and loss of preload for this component, material, and environment combination in other AMR items in LRA Tables 3.4.2-3 and 3.4.2-4. Based on its review of the GALL Report, which states that high-strength steel closure bolts may be subject to SCC and steel closure bolts should be inspected for loss of preload and loss of material due to corrosion, 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 Bolting Integrity program is documented in SER Section 3.0.3.2.1. The staff noted that the applicant enhanced the Bolting Integrity program to monitor high-strength closure bolting (with actual yield strength greater than or equal to 150 ksi) for cracking due to SCC. The AMP enhancement is to revise the program to include the performance of volumetric examinations consistent with the requirements in ASME Code Section XI, Table IWB-2500-1, for high-strength closure bolting (with actual yield strength greater than or equal to 150 ksi). In addition, the AMP includes periodic inspections of closure bolts for the detection of signs of leakage, loss of material, cracking, and loss of preload. The staff finds the applicant's proposal to manage the effects of aging using the Bolting Integrity program acceptable because the program includes: (1) periodic inspection of closure bolting for

indications of loss of material, loss of preload, cracking, and signs of leakage that are capable of detecting degradation before there is a loss of intended function; and (2) volumetric inspections, consistent with ASME Code Section XI, which are capable of detecting cracking due to SCC of high-strength closure bolting (with actual yield strength greater than or equal to 150 ksi).

Stainless Steel Closure Bolting Exposed to Air Outdoor (External). In LRA Tables 3.4.2-3 and 3.4.2-4, the applicant stated that stainless steel closure bolting exposed externally to air outdoor will be managed for cracking by the Bolting Integrity 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 stainless steel closure bolting exposed to air are susceptible to loss of preload and recommends GALL Report AMP XI.M18, “Bolting Integrity,” 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 Tables 3.4.2-3 and 3.4.2-4.

The staff’s evaluation of the applicant’s Bolting Integrity program is documented in SER Section 3.0.3.2.1. The Bolting Integrity program includes periodic visual inspections of closure bolts to detect cracking and signs of leakage that may result from crack initiation. The program also relies on preventive measures such as proper selection of lubricants that do not contain MoS_2 to preclude and minimize cracking due to SCC. The staff finds the applicant’s proposal to manage cracking using the Bolting Integrity program acceptable because the program restricts the use of MoS_2 lubricants known to cause cracking and the periodic visual inspections in the program are capable of detecting cracking or leakage due to crack initiation before there is a loss of intended function.

Stainless Steel Flow Element, Nozzle, Orifice, Piping, Thermowell, Tubing, and Valve Body Exposed to Steam (int). The staff’s evaluation of the TLAA for stainless steel tubing and valve body exposed to steam (int), which are associated with generic note H, is documented in SER Section 3.3.2.3.15.

3.4.2.3.4 Main Steam – 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 component groups.

Carbon Steel Piping Exposed to Steam. In LRA Table 3.4.2-4, the applicant stated that carbon steel piping exposed to steam will be managed for loss of material due to erosion by the Flow-Accelerated Corrosion 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 steel piping exposed to steam is susceptible to loss of material due to general, pitting, and crevice corrosion and recommends GALL Report AMP XI.M2, “Water Chemistry,” to manage the aging effects. In addition, the GALL Report states that steel piping exposed to steam is susceptible to loss of material due to flow-accelerated corrosion and recommends GALL Report AMP XI.M17, “Flow-Accelerated Corrosion,” to manage the aging effects. However, the applicant identified loss of material due to erosion 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 Tables 3.4.2-4. The staff notes that LR-ISG-2012-01 addresses loss of material due to erosion mechanisms and indicates that GALL Report AMP XI.M17 can be used to manage the aging effect. However, LR-ISG-2012-01

only includes water environments and does not address steam environments. This prompted the applicant to conclude that the GALL Report does not include the aging effect for this component, material, and environment combination.

The staff's evaluation of the applicant's Flow-Accelerated Corrosion program is documented in SER Section 3.0.3.2.10. The staff finds the applicant's proposal to manage loss of material due to erosion using the above program acceptable because the distinction between a steam environment and the water environments cited in LR-ISG-2012-01 does not preclude the use of the Flow-Accelerated Corrosion program to manage this aging effect or mechanism.

CASS Flow Element Exposed to Steam (int). In LRA Table 3.4.2-4, the applicant stated there is a TLAA for CASS flow element exposed to steam (int), which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for CASS flow element is documented in SER Section 4.3.

High Strength Steel Closure Bolting Exposed to Air Outdoor (External). The staff's evaluation for high-strength steel closure bolting exposed externally to air outdoor, which will be managed for cracking by the Bolting Integrity program and is associated with generic note G, is documented in SER Section 3.4.2.3.3.

Stainless Steel Closure Bolting Exposed to Air Outdoor (External). The staff's evaluation for stainless steel closure bolting exposed externally to air outdoor, which will be managed for cracking by the Bolting Integrity program and is associated with generic note H, is documented in SER Section 3.4.2.3.3.

Stainless Steel Flow Element, Nozzle, Orifice, Piping, Thermowell, Tubing, and Valve Body Exposed to Steam (int). The staff's evaluation of the TLAA for stainless steel nozzle, orifice, thermowell, tubing, and valve body exposed to steam (int), which is associated with generic note H, is documented in SER Section 3.3.2.3.15.

Stainless Steel Nozzle and Tubing Exposed to Steam (ext). In LRA Table 3.4.2-4, the applicant stated that there is a TLAA for stainless steel nozzle and tubing exposed to steam (ext), which cites generic note H. The staff confirmed that there is a TLAA, as documented in LRA Section 4.3, for this component and material. The staff's evaluation of the TLAA for stainless steel nozzle and tubing is documented in SER Section 4.3.

3.4.2.3.5 Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) – Summary of Aging Management Review – LRA Tables 3.4.2-5-1 through 3.4.2-5-6.

The staff reviewed LRA Tables 3.4.2-5-1 through 3.4.2-5-6, which summarize the results of AMR evaluations for the steam and power conversion systems in Scope for 10 CFR 54.4(a)(2) component groups.

Carbon Steel Components Exposed to Outdoor Air (Internal). The staff's evaluation for the carbon steel modules internally exposed to outdoor air, which will be managed for loss of material by the External Surfaces Monitoring program and are associated with generic note G and plant-specific note 404, is documented in SER Section 3.3.2.3.3.

Stainless Steel Flow Element, Nozzle, Orifice, Piping, Thermowell, Tubing, and Valve Body Exposed to Steam (int). The staff's evaluation of the TLAA for stainless steel tubing and valve

body exposed to steam (int), which are associated with generic note H, is documented in SER Section 3.3.2.3.15.

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:

- Reactor Building
- Nuclear Plant Island Structure
- Turbine Building and Other Structures
- Bulk Commodities

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 Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the structures and component 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 CRs 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 WF3 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 Section 3.5.2.1.

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 3.5.2.2 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, "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, if a de-watering system is relied upon to control settlement	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.1.1)

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
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 to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.1.1)
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 to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.1.2)
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"	No	Not Applicable (BWR only)	Not Applicable
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	Containment Inservice Inspection – IWE and Containment Leak Rate	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"	No	Not Applicable (BWR only)	Not Applicable to WF3
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"	No	Not Applicable (BWR only)	Not Applicable to WF3

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
Pre-stressing system: tendons (3.5.1-8)	Loss of prestress due to relaxation; shrinkage; creep; elevated temperature	Yes, TLAA	Yes, TLAA	Not Applicable to WF3	Not Applicable to WF3 (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	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, detection of aging effects is to be evaluated.	Containment Inservice Inspection – IWE and Containment Leak Rate	Consistent with the GALL Report (see SER Section 3.5.2.2.1)
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, for plants located in moderate to severe weathering conditions	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.1.7)
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, if concrete is not constructed as stated function	Not Used	Not Used (see SER Section 3.5.2.2.1.8)

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
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, if leaching is observed in accessible areas that impact intended function	Not Used	Not Used (see SER Section 3.5.2.2.1.9)
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, if leaching is observed in accessible areas that impact intended function	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.1.9)
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3

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, 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	Not Applicable to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Not Applicable (BWR only)	Not Applicable
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 to WF3	Not Applicable to WF3 (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 (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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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 to WF3	Not Applicable to WF3
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	Containment Inservice Inspection – IWE	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3 (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	Containment Inservice Inspection – IWE and Containment Leak Rate	Consistent with the GALL Report (see SER Section 3.5.2.1.6)
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	Containment Inservice Inspection – IWE and Containment Leak Rate	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	Containment Inservice Inspection – IWE and Containment Leak Rate	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
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	Containment Inservice Inspection – IWE	Consistent with the GALL Report (see SER Section 3.5.2.1.6)
Prestressing system: tendons; anchorage components (3.5.1-32)	Loss of material due to corrosion	Chapter XI.S2, "ASME Section XI, Subsection IWL"	No	Not Applicable to WF3	Not Applicable to WF3
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	Containment Leak Rate	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	Consistent with the GALL Report
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	Containment Inservice Inspection Inspection – IWE and Containment Leak Rate	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	Not Applicable (BWR only)	Not Applicable

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: 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	Not Applicable (BWR only)	Not Applicable
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 (BWR only)	Not Applicable
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 (BWR only)	Not Applicable
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 (BWR only)	Not Applicable
Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt (3.5.1-41)	None	None	NA - No AEM or AMP	Not Applicable (BWR only)	Not Applicable
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.2.1)
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 3.5.2.2.2.1)

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
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 3.5.2.2.2.1)
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 (BWR only)	Not Applicable
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 to WF3	Not Applicable to WF3 (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 3.5.2.2.2.1)
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 to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.2.2)

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
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.2.2)
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.2.2)
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.2.2.2)
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	Structures Monitoring and Water Chemistry Control – Primary and Secondary	Consistent with the GALL Report for the aging effect of loss of material (see SER Section 3.5.2.1.3) Not applicable for the aging effect of cracking (see SER Section 3.5.2.2.2.4)
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 to WF3	Not Applicable
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”	Nos	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
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Inservice Inspection – IWF	Consistent with the GALL Report
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Not Applicable to WF3	Not Applicable to WF3 (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
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Structures Monitoring	Not Applicable to WF3 (see SER Section 3.5.2.1.8)
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	Not Applicable to WF3	Not Applicable

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, 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
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 to WF3	Not Applicable to WF3 (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	Structures Monitoring and Boric Acid Corrosion	Consistent with the GALL Report (see SER Section 3.5.2.1.2)
Masonry walls: all (3.5.1-70)	Cracking due to restraint shrinkage, creep, and aggressive environment	Chapter XI.S5, “Masonry Walls”	No	Masonry Wall	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
Masonry walls: all (3.5.1-71)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Chapter XI.S5, “Masonry Walls”	No	Not Applicable to WF3	Not Applicable to WF3
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	Consistent with the GALL Report
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	Protective Coating Monitoring and Maintenance	Consistent with the GALL Report
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	Not Applicable to WF3	Not Applicable to WF3 (see SER Section 3.5.2.1.1)
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	Not Used	Not Used (see SER Section 3.5.2.1.1)
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 to WF3	Not Applicable to WF3

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 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 (see SER Section 3.5.2.1.4)
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 Control – Primary and Secondary	Consistent with the GALL Report
Steel components: piles (3.5.1-79)	Loss of material due to corrosion	Chapter XI.S6, "Structures Monitoring"	No	Not Applicable to WF3	Not Applicable to WF3 (see SER Sections 3.5.2.1.1 and 3.5.2.3.3)
Structural bolting (3.5.1-80)	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 (3.5.1-81)	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.S3, "ASME Section XI, Subsection IWF"	No	Inservice Inspection – 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	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 (3.5.1-84)	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 to WF3	Not Applicable to WF3
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	Not Applicable to WF3	Not Applicable to WF3
Structural bolting (3.5.1-86)	Loss of material due to pitting and crevice corrosion	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Inservice Inspection – IWF	Consistent with the GALL Report
Structural bolting (3.5.1-87)	Loss of preload due to self-loosening	Chapter XI.S3, “ASME Section XI, Subsection IWF”	No	Inservice Inspection – 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	Consistent with the GALL Report
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	Boric Acid Corrosion	Consistent with the GALL Report
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	Water Chemistry Control – Primary and Secondary and Inservice Inspection – IWF	Consistent with the GALL Report
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	Inservice Inspection – 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 and Fire Water System	Consistent with the GALL Report (see SER Section 3.5.2.1.5)
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	Consistent with the GALL Report (see SER Section 3.5.2.1.7)

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
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	Structures Monitoring	Not Applicable to WF3 (see SER Section 3.5.2.1.9)
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 NUREG–1801 (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:

- Boric Acid Corrosion
- Containment Inservice Inspection – IWE
- Containment Leak Rate
- External Surfaces Monitoring
- Fire Protection
- Fire Water System
- Inservice Inspection – IWF
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Protective Coating Monitoring and Maintenance
- Structures Monitoring
- Water Chemistry Control – Primary and Secondary

LRA Tables 3.5.2-1 through 3.5.2-4 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 3.5.1-6, 3.5.1-7, 3.5.1-22, 3.5.1-36 through 3.5.1-41, and 3.5.1-45, the applicant claimed that the corresponding AMR items in the GALL Report are not applicable because the associated items are only applicable to BWRs. The staff reviewed the SRP-LR, confirmed that these items only apply to BWRs, and finds that these items are not applicable to WF3, which is a CE plant-designed PWR.

For LRA Table 3.5.1, items 3.5.1-1 through 3.5.1-3, 3.5.1-8, 3.5.1-11, 3.5.1-12, 3.5.1-13, 3.5.1-14 through 3.5.1-21, 3.5.1-23 through 3.5.1-25, 3.5.1-27, 3.5.1-32, 3.5.1-42, 3.5.1-46, 3.5.1-48 through 3.5.1-51, 3.5.1-53, 3.5.1-56, 3.5.1-58 through 3.5.1-62, 3.5.1-64, 3.5.1-68, 3.5.1-71, 3.5.1-74, 3.5.1-75, 3.5.1-76, 3.5.1-79, 3.5.1-84, 3.5.1-85, and 3.5.1-94, the applicant claimed that the corresponding items in the GALL Report are not used or not applicable because the component, material, and environment combination described in the SRP-LR does not exist for in-scope SCs at WF3. The staff reviewed the LRA and FSAR 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 FSAR 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 concrete (accessible areas): basemat, exposed to groundwater/soil. The GALL Report recommends GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL," or GALL Report AMP XI.S6, "Structures Monitoring," to manage increase in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for these structures. The applicant stated that this item is not applicable because WF3 has an SCV and does not have an accessible basemat. The applicant stated that the concrete basemat supporting the SCV is integral with the Shield Building concrete foundation and, because it is below the base liner plate of the SCV, it is not accessible. The staff evaluated the applicant's claim and finds it acceptable because the item addresses accessible areas of concrete and the containment basemat is not accessible. The staff's review regarding aging management of the inaccessible containment basemat exposed to groundwater/soil is documented below in this section, which states that the staff verified from LRA Tables 3.5.1 and 3.5.2-2 that the listed aging effects in LRA Table 3.5.1, item 3.5.1-24, are managed for inaccessible areas in groundwater/soil environment using the Structures Monitoring program by LRA Table 3.5.1, item 3.5.1-67 (GALL Report item III.A3.TP-29).

LRA Table 3.5.1, item 3.5.1-21, addresses concrete (accessible areas): basemat; reinforcing steel, exposed to air – indoor, uncontrolled or air – outdoor. The GALL Report recommends GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL," to manage cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for this component group. The applicant stated that the concrete basemat supporting the SCV is integral with the Shield Building concrete foundation and, because it is below the base liner plate of the SCV, it is not accessible. The staff evaluated the applicant's claim and finds it acceptable because the item addresses accessible areas of concrete and the containment basemat is not accessible. The staff also noted that ASME Code Section XI, Subsection IWL, Section IWL-1220, exempts this structure from the provisions of ASME Code Section XI, Subsection IWL, requirements. The staff's review regarding aging management of the inaccessible containment basemat is documented below in this section, which states that the staff verified from LRA Tables 3.5.1 and 3.5.2-2 that the listed aging effects in LRA Table 3.5.1,

item 3.5.1-23, are managed using the Structures Monitoring program by LRA Table 3.5.1, item 3.5.1-66 (GALL Report item III.A3.TP-26 for accessible areas in air – indoor uncontrolled and air outdoor environment).

LRA Table 3.5.1, item 3.5.1-23, addresses "Concrete (inaccessible areas): basemat; reinforcing steel" exposed to air indoor – uncontrolled and air outdoor. The GALL Report recommends GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL," or AMP XI.S6 "Structures Monitoring" to manage "Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel" for this component group. The applicant stated that this item is not applicable because WF3 has an SCV that is supported on the common rigid reinforced concrete basemat foundation for the NPIS, for which the listed aging effects are instead managed by LRA Table 3.5.1, item 3.5.1-66, using the Structures Monitoring program. The staff evaluated the applicant's claim and finds it acceptable because the SCV foundation is part of the common basemat foundation of the NPIS, which the staff verified from LRA Tables 3.5.1 and 3.5.2-2, and that the listed aging effects in LRA Table 3.5.1, item 3.5.1-23, are managed using the Structures Monitoring program by LRA Table 3.5.1, items 3.5.1-65 (GALL Report items III.A3.TP-27 and III.A3.TP-212, respectively, for accessible and inaccessible areas in groundwater/soil environment) and 3.5.1-66 (GALL Report item III.A3.TP-26 for accessible areas in air – indoor uncontrolled and air outdoor environment).

LRA Table 3.5.1, item 3.5.1-24, addresses "Concrete (inaccessible areas): basemat" exposed to groundwater/soil. The GALL Report recommends GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL," or AMP XI.S6 "Structures Monitoring" to manage "[i]ncrease in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack" for this component group. The applicant stated that this item is not applicable because the SCV is supported on the common rigid reinforced concrete basemat foundation for the NPIS, for which the listed aging effects are instead managed by LRA Table 3.5.1, item 3.5.1-67, using the Structures Monitoring program. The staff evaluated the applicant's claim and finds it acceptable because the SCV foundation is part of the common basemat foundation of the NPIS, which the staff verified from LRA Tables 3.5.1 and 3.5.2-2 that the listed aging effects in LRA Table 3.5.1, item 3.5.1-24, are managed for inaccessible areas in groundwater/soil environment using the Structures Monitoring program by LRA Table 3.5.1, item 3.5.1-67 (GALL Report item III.A3.TP-29).

LRA Table 3.5.1, item 3.5.1-27, addresses "penetration sleeves; penetration bellows" of steel, stainless steel, and dissimilar metal welds material exposed to air indoor – uncontrolled or air outdoor. The GALL Report recommends GALL Report AMPs XI.S1, "ASME Section XI, Subsection IWE," and AMP XI.S4, "10 CFR Part 50, Appendix J" to manage cracking due to cyclic loading (CLB fatigue analysis does not exist) for this component group. The applicant stated that WF3 does have a CLB fatigue analysis for penetration bellows, which is evaluated in LRA Section 4.6. However, the applicant's statement only discusses penetration bellows and does not address penetration sleeves, which implies that this item is not applicable to penetration sleeves. Further, since LRA Table 2.4-1 includes penetration sleeves as a component subject to an AMR, and there are no Table 2 items corresponding to SRP-LR item 3.5.1-27 or item 3.5.1-9, the staff is not clear how the penetration sleeves component will be adequately managed for cumulative fatigue damage or cracking due to cyclic loading aging effect for the period of extended operation if CLB fatigue analysis does not exist for the component. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.2.2.1.5-1, which, in part, requested the applicant to provide justification for not including Table 2 AMR items in LRA Table 3.5.2-1 for SRP-LR Table 3.5.1, item 3.5.1-27, for penetration sleeves to manage cracking due to cyclic loading when CLB fatigue analysis does not exist for the

component. Detailed discussion of the RAI response and staff evaluation is provided in SER Section 3.5.2.2.1.5; however, the applicant's response and staff evaluation of part of the RAI response related to non-applicability of SRP-LR item 3.5.1-27 is summarized below.

In its response by letter dated December 7, 2016, the applicant stated that the WF3 penetration sleeves are equipped with bellows to accommodate movement of the penetration piping and sleeves due to thermal expansion. The applicant further stated that this prevents or minimizes the imposition of loads on the penetration sleeves because of differential movement between the SCV and the Shield Building; therefore, penetration sleeves are not subject to aging effects due to cyclic loading and SRP-LR Table 3.5.1, item 27, does not apply. The applicant also revised LRA Table 3.5.1, item 27, accordingly, and indicated that applicable penetration components are nevertheless included in the Containment Inservice Inspection – IWE program and Containment Leak Rate program.

The staff finds the applicant's response that fatigue damage due to cyclic loading is not an AERM for penetration sleeves acceptable because the penetration sleeves at WF3 are equipped with bellows that accommodate differential movement due to loads such as thermal expansion and seismic without imposing undue stresses on these components; therefore, WF3 penetration sleeves are subject to minimal cyclic loading. The staff thus concurs with the applicant's determination that SRP-LR Table 3.5.1, item 27, is not applicable to penetration sleeves at WF3. The staff's concern is resolved.

LRA Table 3.5.1, item 3.5.1-56, addresses concrete exposed to water. The GALL Report recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to manage loss of material due to abrasion or cavitation for this component group. The applicant stated that this item is not applicable because the item is specific to Group 6 structures and WF3 does not have Group 6 structures. The staff evaluated the applicant's claim and noted that WF3 has concrete components exposed to water that could be susceptible to the identified aging effect. By letter dated November 7, 2016, the staff issued RAI 3.5.1.56-1 requesting that the applicant explain how concrete components exposed to water will be managed for loss of material due to abrasion or cavitation.

In its response dated December 7, 2016, the applicant stated that per EPRI 1015078, "Plant Support Engineering: Aging Effects for Structures and Structural Components," abrasion and cavitation may cause a loss of material in concrete structures that are continuously exposed to flowing water containing abrasives or velocities greater than 40 ft. per second for open channels. The concrete structures exposed to flowing water are the wet cooling tower basins, which when in service only see flow rates of less than 10 ft. per second. Since the flow rates are less than 40 ft. per second, the applicant concluded that loss of material due to abrasion and caviation is not an AERM. Additionally, the applicant noted that plant-specific operating experience has not indicated thus far the aging effect loss of material due to abrasion. The applicant also updated LRA Table 3.5.1, item 3.5.1-56, to include this discussion and to remove the discussion regarding Group 6 structures.

The staff reviewed the applicant's response and noted that the flow rates in the cooling tower basins are low enough to preclude loss of material due to abrasion in accordance with the information provided in EPRI 1015078. Furthermore, the staff noted that the water in the basins is mildly sloshing water and the applicant has no operating experience with loss of material due to abrasion. Additionally, the staff verified that these structures are within the scope of the Structures Monitoring program and will be monitored for degradation, regardless of the aging mechanism. The staff finds the applicant's response acceptable because it provides an

appropriate technical explanation of why loss of material due to abrasion and cavitation is not applicable to WF3 structures exposed to flowing water. Additionally, these structures will be monitored via visual inspections under the Structures Monitoring program and indications of degradation will be addressed regardless of the aging mechanism or "group" the applicant assigned to the structures. The staff's concern described in RAI 3.5.1-56 is resolved.

LRA Table 3.5.1, item 3.5.1-58, addresses earthen water-control structures exposed to water. The GALL Report recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to manage loss of material and loss of form for this component group. The applicant stated that this item is not applicable because the item is specific to Group 6 components and WF3 does not have Group 6 structures. The staff evaluated the applicant's not applicable claim based on technical merit, regardless of the "group" the applicant assigned to the structures. The staff verified that WF3 does not have any earthen water-control components within the scope of license renewal. Therefore, the staff finds the applicant's not applicable claim acceptable because there are no earthen structures susceptible to this aging effect at WF3.

LRA Table 3.5.1, items 3.5.1-59, 3.5.1-60, and 3.5.1-61, address concrete exposed to air, water, or soil. The GALL Report recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to manage the associated aging effects for this component group. The applicant stated that these items are not applicable because the items are specific to Group 6 components and WF3 does not have Group 6 structures. The staff evaluated the applicant's not applicable claim based on technical merit, regardless of the "group" the applicant assigned to the structures. The staff verified that all of the associated material, aging effect, and environment combinations addressed by these items are covered by similar items in the LRA. These items recommend GALL Report AMP XI.S6, "Structures Monitoring" (LRA Table 3.5.1, items 3.5.1-65, 3.5.1-64, and 3.5.1-63, respectively). The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. Using the applicant's Structures Monitoring program to manage corresponding aging effects of these components is acceptable because the Structures Monitoring program uses periodic visual inspections equivalent to the inspections included in the recommended GALL Report AMP.

The staff finds the applicant's approach acceptable, regardless of assigned "group," because 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 3.5.1-68, addresses high-strength structural bolting exposed to air – indoor, uncontrolled. The GALL Report recommends GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF," to manage cracking due to SCC for this component group. The applicant stated that this item is not applicable because a continuous wetted environment and MoS_2 must be present to initiate SCC in high yield-strength bolting with actual measured yield strength greater than or equal to 150 ksi and greater than 1 inch in diameter. The applicant also stated that since MoS_2 thread lubricants are not used at WF3 for structural bolting applications, "SCC of high strength structural bolting is not an AERM at WF3." The staff evaluated the applicant's claim and found that SCC remains a potential aging effect for these components. While GALL Report AMP XI.S3 states that the use of MoS_2 lubricants as a lubricant is a potential contributor to SCC in high-strength bolts and does recommend the lubricant not be used, the GALL Report does not limit MoS_2 thread lubricant as the only potential contributor to SCC in the above-mentioned high-strength bolts. A potentially wetted environment containing

other contaminants could potentially cause SCC to occur in high-strength bolting in sizes greater than 1-inch nominal diameter. Therefore, the staff did not find that the applicant had adequate basis for not managing the aging effect of cracking due to SCC for high-strength structural bolting greater than 1-inch diameter in ISI-IWF applications. As a result, the staff issued RAI B.1.16-1 by letter dated October 12, 2016, related to this issue for several programs, including the Inservice Inspection – IWF program. The staff's review and resolution of RAI B.1.16-1 is documented in SER Section 3.0.3.2.11.

The applicant's January 9, 2017, response to RAI B.1.16-1 states that there are no high-strength structural bolts with actual measured yield strength greater than or equal to 150 ksi in sizes greater than 1-inch diameter within the scope of the ISI – IWF program. Consistent with the response to RAI B.1.16-1, the applicant also revised Table 3.5.1, item 3.5.1-68, to state "WF3 does not have high-strength structural bolts with actual measured yield strength greater than or equal to 150 ksi in sizes greater than 1-inch diameter within the scope of the WF3 Inservice Inspection – IWF program. Therefore, the listed aging effect is not an AERM for ISI (IWF) high-strength bolting." The staff evaluated the applicant's response and finds it acceptable because WF3 does not use bolting material with actual measured yield strength greater than or equal to 150 ksi and greater than 1 inch in diameter that could be susceptible to SCC in ISI-IWF applications.

LRA Table 3.5.1, items 3.5.1-74 and 3.5.1-75, address sliding support bearings and surfaces made of Lubrite® exposed to air–indoor uncontrolled or air–outdoor. The GALL Report recommends GALL Report AMPs XI.S6, "Structures Monitoring," and XI.S3, "ASME Section XI, Subsection IWF," to manage loss of mechanical function due to corrosion, distortion, dirt, debris, overload, and wear of the component groups associated with items 3.5.1-74 and 3.5.1-75, respectively. The applicant stated that these items are not applicable to Lubrite® plates because the "listed aging mechanisms are event driven and typically can be avoided through proper design." For item 3.5.1-75, the applicant added that the aging effect of loss of material could cause loss of mechanical function and, therefore, loss of material will be addressed under item 3.5.1-77 for component support members.

The staff evaluated the applicant's claim and noted that for Lubrite® components exposed to an air-indoor uncontrolled or air-outdoor environment addressed in item 3.5.1-75, the applicant stated it will manage loss of material that could cause loss of mechanical function. However, item 3.5.1-74 does not similarly propose to manage loss of material for the same material and environment combination. Although Lubrite® bearings are characterized as maintenance-free, they can still be subject to the aging effect of loss of material due to wear or corrosion, debris, or dirt that could lead to a loss of intended function. GALL Report AMP XI.S6 recommends that the aging effects for Lubrite® be managed by performing periodic visual examinations under the Structures Monitoring program. Absent an inspection of Lubrite® plates, it is not clear how the aging effects will be identified and adequately managed so that intended function(s) will be maintained consistent with the CLB during the period of extended operation. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.1.74-1 requesting that the applicant provide additional basis to support the determination that the aging effects of loss of material due to wear or corrosion, debris, or dirt that could lead to a loss of intended function are not applicable to Lubrite® plates and justification for not performing periodic inspections to identify aging effects during the period of extended operation.

In its response letter dated December 7, 2016, the applicant stated that it has not identified Lubrite® sliding surfaces at WF3 that pertain to SCs associated to AMR item 3.5.1-74 and, therefore, inspection of such components is not applicable. The applicant also revised LRA

Table 3.5.1, item 3.5.1-74, to state that SRP-LR "items referencing this item are associated with Lubrite[®], graphitic tool steel, Fluorogold and Lubrofluor, which have not been identified for WF3 components associated with this item." However, the applicant stated that there are Lubrite® plates associated with the RCS at WF3 addressed in the LRA under item 3.5.1-75. The staff finds the applicant's claim for item 3.5.1-74 acceptable because (1) the applicant clarified that there are no Lubrite® sliding surfaces identified at WF3 associated with SCs described in item 3.5.1-74, and (2) the staff did not find Lubrite® SCs applicable to item 3.5.1-74 in the FSAR. However, the staff finds the applicant's response to RAI 3.5.1.74-1 only partially acceptable because although it resolved the staff's concerns associated with item 3.5.1-74, it raised concerns regarding the management of aging effects for Lubrite® sliding surfaces in the RCS associated with item 3.5.1-75. The staff notes that LRA Table 3.5.1, item 3.5.1-75 states, in part, that "[l]oss of material which could cause loss of mechanical function is addressed under [i]tem 3.5.1-77 related to component support members." LRA Table 3.5.1, item 3.5.1-77 states that the Structures Monitoring program manages the listed aging effects. The staff noted that for item 3.5.1-75, the GALL Report recommends GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF," to manage the aging effects of Class 1, 2, and 3 sliding support surfaces made of Lubrite®; graphitic tool steel, Fluorogold, and Lubrofluor. The staff also noted that the GALL Report AMP XI.S3 contains recommendations that are not included in the Structures Monitoring program. Some of these recommendations include, but are not limited to, the following:

- requiring that a sample of ASME Class 1, 2, and 3 piping supports and supports other than piping supports (Class 1, 2, 3, and metal containment) that are not exempt from examination be examined as specified in Table IWF-2500-1, "Examination Categories"
- establishing acceptance criteria for sliding surfaces that identifies arc strikes, weld spatter, paint, scoring, roughness, or general corrosion on sliding surfaces as unacceptable conditions

The staff noted that the applicant's Structures Monitoring program does not include the same provisions as the above and other GALL Report recommendations for managing the aging effects on the identified RCS supports with Lubrite® sliding surfaces. In addition, the staff noted that although the applicant claims it will be managing aging effects for these components, there are no LRA Table 2 AMR items identifying Lubrite® as a material for sliding surfaces of component supports that would be subject to an AMR. It was not clear whether the Lubrite® plates in the RCS are component supports applicable to the GALL Report AMP XI.S3 recommendations and, if so, whether the Structures Monitoring program will incorporate the recommendations of GALL Report AMP XI.S3 for these components. The staff also noted that the SRP-LR states that the identification of applicable aging effects based on materials, environment, and operating experience should be provided in the LRA to demonstrate that the requirements of 10 CFR 54.21(a)(3) are met. Since there are no LRA Table 2 AMR items identifying Lubrite® as a material for sliding surfaces of component supports that would be subject to an AMR, it is not clear how the criteria in 10 CFR 54.21(a)(3) is being met. Therefore by letter dated January 26, 2017, the staff issued RAI 3.5.1.74-1a requesting that the applicant (1) state whether the Lubrite® plates are ASME Code Class 1, 2, and/or 3 supports and, if so, state how the aging effects will be managed under the Structure Monitoring program consistent with the recommendations in GALL Report AMP XI.S3; and (2) update the LRA to include AMR items for Lubrite® or state how the criteria of 10 CFR 54.21(a)(3) will be met without identifying Lubrite® as a material in the Table 2 AMR items.

In its response letter dated February 23, 2017, the applicant stated for request (1) that "ASME Code Class 1, 2, or 3 supports that incorporate the use of Lubrite® sliding surfaces are inspected under the Inservice Inspection – IWF program and addressed under AMR item 3.5.1-75 in LRA Table 3.5.1. The applicant revised LRA Table 3.5.1 to state that the aging effect of loss of material that could cause loss of mechanical function for SCs associated with AMR item 3.5.1-75 will be addressed under AMR items 3.5.1-57 and 3.5.1-91 (which credit the Inservice Inspection – IWF AMP consistent with GALL Report recommendations) instead of AMR item 3.5.1-77. In response to request (2) the applicant stated that no individual AMR item was provided in the LRA for Lubrite® as a material because the Lubrite® sliding surfaces are integral with the supports and, as such, they are inspected whenever the supports they are integral with are subject to inspections. The staff's evaluation of the Inservice Inspection – IWF program is documented in SER Section 3.0.3.2.11. The staff finds the applicant's response and proposal to manage these components under AMR items 3.5.1-57 and 3.5.1-91 for the aging effects of loss of material for Lubrite® sliding surfaces associated with AMR item 3.5.1-75 acceptable because: (1) AMR items 3.5.1-57 and 3.5.1-91 are component supports whose aging effects will be managed by the Inservice Inspection – IWF program consistent with the recommendations in GALL Report AMP XI.S3, and (2) Lubrite® sliding surfaces are considered an integral part of these supports and will be inspected whenever these supports are inspected. The staff's concerns described in RAIs 3.5.1.74-1 and 3.5.1.74-1a are resolved.

LRA Table 3.5.1, item 3.5.1-79, addresses loss of material for steel piles exposed to groundwater/soil. The GALL Report recommends AMP XI.S6, "Structures Monitoring," to manage loss of material due to corrosion for this component group. The applicant stated that this item is not applicable because "WF3 has no steel piles subject to the listed aging effect therefore this item was not used."

The staff evaluated the applicant's claim and noted that LRA item 3.5.1-79 is not used in any LRA "Table 2" AMR results. However, the staff noted that LRA Table 2.4-3 indicates that there are steel piles in soil in the vicinity of the Turbine Building that support the function of 10 CFR 54.4(a)(3) equipment. LRA Section 2.4.3 describes the steel piles as "concrete piles with steel pipe casings driven into the subgrade." The AMR results for LRA Table 3.5.2-3 with generic note I and a plant-specific note 501 referring to the concrete piles with steel pipe casing states that operating experience has shown that only minor to moderate corrosion has occurred for steel piles driven in disturbed soil, and if driven in "undisturbed" soil, they remain relatively unaffected by corrosion. The plant-specific note 501 also states: "[t]he concrete inside the steel casing is not susceptible to degradation that could impair the ability of the concrete to perform its intended function." The LRA dispositions the loss of material aging effect for the driven steel pipe pile casings as requiring no management without providing a technical justification.

The staff determined that additional information was needed. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.1.79-1, requesting the applicant (a) to clarify whether the steel piles are within the scope of license renewal; (b) if so, how any loss of material aging effect attributed to the piles will be managed; otherwise, provide the technical justification for excluding these piles from having such an aging effect managed during the period of extended operation; and (c) resolve any inconsistencies between LRA Tables 3.5.1, 3.5.2-3, and 2.4-3 relevant to steel piles. In its response dated December 7, 2016, the applicant stated that the steel piles with concrete infills are within the scope of license renewal and properly identified in LRA Table 2.4-3. The applicant restated that the AMR as listed in LRA Table 3.5.2-3 requires no management of the aging effect of loss of material as noted in plant-specific note I, 501 because "[s]teel piles driven into undisturbed soils are unaffected by corrosion." To further support this claim, the applicant referenced EPRI TR-1015078, "Plant

Support Engineering: Aging Effects for Structures and Structural Components (Structural Tools)," and concluded "[i]ndustry operating experience has shown that … the type and amount of corrosion observed on steel pilings (or casings) driven into undisturbed natural soil, regardless of the soil characteristics and properties, is not sufficient to significantly affect the strength of pilings as load bearing structures." Following a clarification teleconference dated January 12, 2017, the applicant supplemented its response to RAI 3.5.1.79-1, and stated that the in-steel piles (or casings) have a minimum diameter of 12 inches and a wall thickness of 0.375 inches and were driven in undisturbed soil several hundred feet away from the Turbine Building.

The staff reviewed the applicant's response and confirmed that pipe piles conform to the standard schedule of ANSI/ASME B36.10, "Welded and Seamless Wrought Steel Pipe," and ASTM 252, "Standard Specification for Welded and Seamless Steel Pipe Piles," for thickness and diameter. The staff then reviewed EPRI TR 1015078 and its referenced Department of Commerce, National Bureau of Standards Monographs by Romanoff on "Corrosion of Steel Pilings in Soils," and "Papers on Underground Corrosion of Steel Piling 1962-1971." The referenced material describes an undisturbed soil "as an underground environment disturbed only by penetration from the driven piling coupled with the assumption that there was no prior disturbance by recent excavation." The publications also state that "[i]n general, no appreciable corrosion of steel piling was found in undisturbed soil below the water table regardless of the soil types or soil properties encountered. Above the water table …. corrosion was found to be variable but not serious." A further review of the publications indicates that loss of material due to corrosion of steel piles depends on the aggressiveness of the soil to foster corrosion and is contingent on a combination of such factors as pH, moisture, and oxygen content, or disturbance of the soil.

To evaluate the acidity of the soil, the staff reviewed FSAR Table 2.4-15, which addresses the topical acidity, as well as the chloride and sulfate concentrations in the groundwater/soil. It states that the range of values for groundwater pH at the site is 7.6-8.65, with 123-216 ppm in chlorides, and 1-1.4 ppm in sulfates. The range of these values compared with the GALL Report criteria for non-aggressive soil (pH > 5.5, chlorides < 500 ppm, or sulfates < 1500 ppm) identifies the groundwater/soil to be non-aggressive. In addition, LRA Section B.1.38, Structures Monitoring program, states that WF3 "will perform periodic sampling and chemical analysis of ground water for pH, chlorides, and sulfates on a frequency of at least once every 5 years to ensure that the ground water has not become aggressive." To determine whether the soil in and around the concrete infilled pipe piles supported slab of the fire water storage tanks remained undisturbed during and after the pile driving, the staff reviewed FSAR Section 2.5.4.5.1. The section describes excavations undertaken for Category I structures and for the Turbine Building, but none in the area of interest to disqualify the soil from being considered as undisturbed. The staff also reviewed the site "Plot Plan" (FSAR Figure 1.2) and confirmed that the foundation for the fire water storage tanks is several hundred feet away from the Turbine Building. Based on the above, the staff concludes that there is a reasonable assurance that the site groundwater/soil is non-aggressive, will be periodically monitored for aggressiveness so that corrective actions can be taken if required, and that the soil in the area where the steel piles were driven is undisturbed. These site conditions and measures, supported by industry operating experience, provide a reasonable assurance that significant corrosion of the concrete infilled steel pipe piles is not expected to occur to impair their load-bearing capacity during the period of extended operation.

In addition, the applicant through its enhanced Structures Monitoring program and Fire Water System program described in LRA Sections B.1.38 and B.1.13 and evaluated in SER

Sections 3.5.2.1.1 and 3.0.3.2.9, respectively, will inspect, monitor, and evaluate any potential age-related degradation of the concrete slab and metal components of the fire water storage tanks. This will ensure that the fire water storage tank foundation system (concrete slab and steel pipe piles with concrete infills) will continue to provide support for the 10 CFR 54.4(a)(3) equipment.

The staff finds the applicant's response acceptable because: (a) the steel pipe piles with concrete infills are within scope of license renewal and subject to an AMR; (b) there is a reasonable assurance these steel pipe piles driven in non-aggressive, undisturbed soil would not experience significant degradation and that loss of material due to corrosion would not impair their load-bearing capacity during the period of extended operation (also stated in the revised "Discussion" section of LRA item 3.5.1-79); (c) visual inspections under the Structures Monitoring program, and other programs for accessible areas of the fire water storage tank foundations, will be able to detect any potential degradation associated with this aging effect (e.g., cracking, settlement); and (d) the applicant's RAI response clarifies the inconsistency between LRA Table 2.4-3, 3.5.1 (item 79), and 3.5.2-3 item(s) associated with steel piles. The staff's concerns described in RAI 3.5.1.79-1 are resolved.

The staff concludes that for LRA item 3.5.1-79, the applicant has demonstrated that for concrete infilled steel pipe piles exposed to groundwater/soil, loss of material due to corrosion is not an AERM during the period of extended operation. Accordingly, the intended function(s) of the components will be maintained consistent with the CLB in support of 10 CFR 54.4(a)(3) equipment during the period of extended operation.

3.5.2.1.2 Cracking Due to Stress Corrosion Cracking

LRA Table 3.5.1, item 3.5.1-69, addresses carbon steel high-strength structural bolting exposed to air-indoor uncontrolled environment, which will be managed for cracking due to SCC. For the AMR item that cites generic note E, the LRA credits the Structures Monitoring program and the Boric Acid Corrosion program to manage the aging effect for carbon steel high-strength bolting from the SITs and the RCS supports. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using visual inspections supplemented with volumetric or surface examinations to manage the effects of aging. In its response to RAI B.1.38, dated January 9, 2017, the applicant states that only bolts determined to have been exposed to a corrosive environment with the potential to cause SCC will be identified as within the population where SCC is a concern, and will be part of the sample population subject to volumetric examination. The staff's complete review of this RAI B.1.38 is documented in SER Section 3.0.3.2.20.

The staff's evaluation of the applicant's revised Structures Monitoring program and Boric Acid Corrosion program are documented in SER Sections 3.0.3.2.20 and 3.0.3.1.1, respectively. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for ASTM A-540 high-strength bolts in sizes greater that 1-inch diameter through the use of visual inspections supplemented with volumetric examination for a sample population of those bolts identified as exposed to a corrosive environment conducive to SCC. The staff further noted that the AMP also proposes to perform visual inspections, at a 5-year frequency, to monitor and evaluate, as necessary, the surface condition of the bolting and adjacent structures. The AMP will ensure that the environment remains non-corrosive and without the potential to cause SCC during the period of extended operation. The staff notes that in the response to RAI B.1.38, the applicant stated that the Boric Acid Corrosion program provides for inspections

during each refueling outage to identify borated water leakage and to ensure that corrosion caused by leaking borated water does not lead to unacceptable degradation of the leakage source or adjacent structures or components. Based on its review of components associated with item 3.5.1-69 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program and the Boric Acid Corrosion program acceptable because (1) the programs monitor and evaluate, as necessary, the environment of ASTM A-540 high-strength bolts in sizes greater than 1-inch diameter using periodic visual inspections at least once every 5 years to ensure that the environment remains non-corrosive and without the potential to cause SCC between inspections; (2) the program includes the criteria to evaluate and identify high-strength bolts exposed to a corrosive environment conducive to SCC; and (3) the program contains actions to supplement the visual inspections with volumetric examination if a corrosive environment is identified.

The staff concludes that for LRA item 3.5.1-69, 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).

3.5.2.1.3 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-52, addresses stainless steel tank liners exposed to water-standing, which will be managed for cracking due to SCC and loss of material due to pitting and crevice corrosion. For the AMR items that cite generic note E, the LRA credits the Structures Monitoring program and Water Chemistry Control – Primary and Secondary program to manage the aging effect of loss of material due to pitting and crevice corrosion for stainless steel safety injection system sump screens/strainers, reactor cavity seal ring and hatches, cooling tower fill/mist eliminators, condensate storage pool liner plate, liner plate, refueling water storage pool liner plate, and vortex breakers/screens/strainers. The GALL Report recommends that "a plant-specific AMP is to be evaluated" to provide reasonable assurance that this aging effect is adequately managed.

The applicant stated that the applicability of item 3.5.1-52 is limited to the aging effect of loss of material due to pitting and crevice corrosion, and not to cracking due to SCC. The applicant stated that this item is not applicable because "cracking due to stress corrosion is not an AERM for an environment of water-standing < 140°F (< 60°C). There are no stainless steel tank liners with intended functions exposed to an environment of water-standing > 140°F (>60°C)." The staff notes that in the GALL Report, water-standing is defined as "[w]ater that is stagnant and unrefreshed, thus possibly resulting in increased ionic strength up to saturation." The staff determined that the applicant's statement that SCC is not an applicable aging mechanism because the components are only exposed to water-standing at temperatures less than 140 °F is contrary to the GALL Report, which uses a temperature threshold of less than 140 °F as not having SCC potential only for the environment of treated water, not for water-standing. However, the staff noted that LRA Section 3.5.2.2.2.4, associated with the aging effects of cracking due to SCC and loss of material due to pitting and crevice corrosion states that "SCC of stainless steel liners is not credible because they are not exposed to a harsh environment (significant presence of contaminants [halogens, specifically chlorides])." The staff noted that the discussion only referred to the component stainless steel liners, and did not specifically discuss the stainless steel safety injection system sump screens/strainers, reactor cavity seal ring and hatches, cooling tower fill/mist eliminators, condensate storage pool liner plate, liner

plate, refueling water storage pool liner plate, and vortex breakers/screens/strainers to which LRA “Table 2” items refer. During a teleconference on January 12, 2017, the staff asked the applicant to clarify whether the components the applicant applied to AMR item 3.5.1-52 (stainless steel safety injection system sump screens/strainers, reactor cavity seal ring and hatches, cooling tower fill/mist eliminators, condensate storage pool liner plate, liner plate, refueling water storage pool liner plate, and vortex breakers/screens/strainers) are maintained free of contaminants that could cause cracking due to SCC. The applicant clarified that in applying the Table 1, item 3.5.1-52, to the above-mentioned components, it verified that the water-standing environment for each is maintained free of contaminants.

The staff evaluated the applicant’s claim and finds it acceptable because the water-standing environment that these components will be exposed to will be maintained free of contaminants; therefore, there is not a concern that cracking due to SCC will occur.

The staff’s evaluation of the applicant’s Structures Monitoring program and Water Chemistry Control – Primary and Secondary program are documented in SER Section 3.0.3.2.20 and 3.0.3.1.19, respectively. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for structures and structural components through the use of visual inspections. The staff reviewed the Structures Monitoring program and determined it needed clarification on whether these potentially inaccessible components would be able to be visually inspected. Therefore, it issued RAI 3.5.1.52-1, by letter dated November 7, 2016, requesting information on how these components would be inspected. The applicant responded by letter dated December 7, 2016, and stated that the program will ensure that these components that are not easily accessible for visual inspection will be inspected at least once every 5 years. The applicant stated that it will use tools such as flashlights, cameras, and other inspection aids such as divers to ensure access and proper visual inspections of these components. For the components that the applicant proposes to use the Water Chemistry Control – Primary and Secondary program in addition to the Structures Monitoring program, the staff noted that the Water Chemistry Control – Primary and Secondary program will manage loss of material of in-scope components through periodic monitoring and control of water chemistry. Based on its review of components associated with item 3.5.1-52 for which the applicant cited generic note E, the staff finds the applicant’s proposal to manage the effects of aging using the Structures Monitoring program and, where applicable, the Water Chemistry Control – Primary and Secondary program acceptable because (1) the Structures Monitoring program will be enhanced to ensure that visual inspections will be performed, and that these inspections will detect loss of material due to pitting and crevice corrosion for these submerged or potentially inaccessible components, and (2) the Water Chemistry Control – Primary and Secondary program will ensure that the water chemistry is monitored and controlled to keep peak levels of contaminants below system-specific limits for applicable components.

3.5.2.1.4 Loss of Material Due to Corrosion

LRA Table 3.5.1, item 3.5.1-77, addresses all structural steel components from structures exposed to air – indoor uncontrolled, air – outdoor, and fluid environment, which will be managed for loss of material due to corrosion. For the AMR item that cites generic note E, the LRA credits the Structures Monitoring program to manage the aging effect for galvanized steel in the NPIS exposed to a fluid environment. The GALL Report recommends GALL Report AMP XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S7 recommends using visual inspections to manage the effects of aging. The GALL Report also recommends periodic inspections to be performed at

least once every 5 years with provisions for increased inspection frequency to ensure no loss of intended function between inspections.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for structural steel through the use of visual inspections. The staff also noted that LRA Section B.1.38 includes an enhancement to the "detection of aging effects" program element to ensure that structures (including submerged structures) are inspected at least once every 5 years with provisions for more frequent inspections. Based on its review of components associated with item 3.5.1-77 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because a periodic visual inspection of structural steel components exposed to fluid environment will be performed at least once every 5 years with provisions for more frequent inspections to ensure no loss of intended function between inspections, consistent with the recommendations in GALL Report AMP XI.S7.

The staff concludes that for LRA item 3.5.1-77, 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 General and Pitting Corrosion

LRA Table 3.5.1, item 3.5.1-92, addresses carbon steel support members; welds; bolted connections; support anchorage to building structure exposed to air-indoor, uncontrolled, or air-outdoor, for loss of material due to general and pitting corrosion. For the AMR item that cites generic note E, the LRA credits the Fire Water System program to manage the aging effect for carbon steel fire hose reels. The GALL Report recommends AMP XI.S6, "Structures Monitoring," to manage the effects of aging for fire hose reels through periodic visual examinations.

The staff's evaluation of the applicant's Fire Water System program is documented in SER Section 3.0.3.2.9. The staff noted that the Fire Water System program proposes to manage the effects of aging for in-scope long-lived passive water-based fire suppression system components with periodic flow testing and visual inspections. In its review of the Fire Water System program during the onsite AMP audit, the staff did not find any fire hose reels listed as a component managed by the program. It was also not clear to the staff at what periodicity the component would be visually inspected consistent with GALL Report recommendations. The staff determined that it needed additional information to verify consistency of the review with the GALL Report provided guidance. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.1.92-1 requesting that the applicant state how the Fire Water System program will adequately manage the aging effect for loss of material due to general and pitting corrosion for carbon steel fire hose reels associated with table 3.5.1, item 92.

In its response dated December 7, 2016, the applicant clarified that plant procedures specify visual inspections of carbon steel fire hose reels for loss of material, and that the inspection frequency is quarterly. The staff determined that the applicant had provided sufficient additional information and the concern is resolved. Based on its review of components associated with item 3.5.1-92, for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Fire Water System program acceptable because fire hose reels will be inspected every 3 months instead of the 5-year periodicity

recommended by the GALL Report AMP XI.S6, "Structures Monitoring." Because visual inspections will be conducted on a quarterly basis, the staff has reasonable assurance that the aging effect of loss of material due to general and pitting corrosion will be adequately managed.

The staff concludes that for LRA item 3.5.1-92, 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).

3.5.2.1.6 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-31, addresses steel "pressure retaining bolting, steel elements: downcomer pipes" exposed to "air-indoor, uncontrolled" environment, which will be managed for loss of material due to general, pitting, and crevice corrosion. The GALL Report recommends GALL Report AMP XI.S1, ASME Code Section XI, Subsection IWE, to provide reasonable assurance that this aging effect is adequately managed.

During its review of components associated with LRA Table 3.5.1, item 3.5.1-31, for which the applicant cited generic note A, the staff noted that LRA Table 3.5.2-1 included, on LRA page 3.5-52, an AMR item for component type "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch: locks, hinges and closure mechanisms" of "carbon steel" material in "air-indoor, uncontrolled" environment for "loss of material" aging effect that credited and claimed consistency with GALL Report item II.B4.CP-148 corresponding to SRP-LR Table 3.5-1, item 31. The staff noted that the GALL Report item II.B4.CP-148 applies to component "pressure-retaining bolting" for BWR containments, and not the components described in the LRA Table 3.5.2-1 item referenced above. The staff also noted that LRA Table 3.5.2-1 included, on LRA page 3.5-52, another AMR item for component type "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch" with the same material, environment, and aging effect combination that credited GALL Report item II.A3.C-16 (corresponding to Table 1 item 3.5.1-28) with a generic note A. Therefore, by RAI 3.5.2-1-1 (3.5.2-1 as referenced by the applicant) dated September 15, 2016, the staff requested that the applicant clarify the apparent discrepancy and/or duplication in component type associated with the LRA Table 3.5.2-1 item for component type "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch: locks, hinges and closure mechanisms" noted above for the loss of material aging effect, and establish how it is consistent with the GALL Report item II.B4.CP-148 to justify a generic note A.

In its response to RAI 3.5.2-1, by letter dated October 13, 2016, the applicant provided the following clarification for the noted discrepancy:

> There is no duplication of line items in the license renewal application (LRA) Table 3.5.2-1. The first line item is for component type "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch." The second line addresses the locks, hinges and closure mechanisms associated with those components. However, the LRA Table 3.5.2-1 line item for component type "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch: locks, hinges and closure mechanisms" with the aging effects loss of material on Page 3.5-52 of the LRA, is revised to credit NUREG–1801 line item II.A3.C-16 (corresponding to Table 1 item 3.5.1-28) with a generic Note C.

The staff finds the applicant's response to RAI 3.5.2-1 acceptable because the applicant clarified and corrected the discrepancy the staff noted with regard to consistency with the GALL Report of the above-mentioned AMR item, crediting item II.B4.CP-148 corresponding to LRA item 3.5.1-31. The applicant also appropriately revised the LRA Table 3.5.2-1 item for component "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch: locks, hinges and closure mechanisms" for loss of material aging effect to credit GALL Report item II.A3.C-16, corresponding to Table 3.5.1-1, item 28, with a generic note C (in lieu of the previously stated item II.B4.CP-148, corresponding to LRA item 3.5.1-31). This revised LRA item with generic note C is by definition consistent with the GALL Report with regard to material, environment, aging effect, and AMP with only the component being different. Therefore, by using GALL Report item II.A3.C-16 16 corresponding to LRA Table 3.5.1-1, item 28, the staff finds that the component "Steel components: personnel airlock, escape lock, construction hatch, maintenance hatch: locks, hinges and closure mechanisms" will be adequately managed for the aging effect of loss of material using the Containment Inservice Inspection – IWE and Containment Leak Rate AMPs. The staff's evaluation of these AMPs are documented in SER Sections 3.0.3.2.4 and 3.0.3.1.3, respectively. The staff's concern in RAI 3.5.2-1 is resolved.

The staff concludes that for LRA items 3.5.1-28 and 3.5.1-31, 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 3.5.1-83, addresses steel structural bolting exposed to outdoor air or fluid 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 Structures Monitoring program to manage the aging effect for steel and galvanized steel anchor bolts and structural bolting in an outdoor air or fluid environment. The GALL Report recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S7 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for steel and galvanized steel anchor bolts and structural bolting through the use of periodic visual inspections. Based on its review of components associated with item 3.5.1-83 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because the proposed AMP uses visual inspections similar to those in the GALL Report recommended AMP and the proposed AMP addresses the materials and environments associated with item 3.5.1-83.

The staff concludes that for LRA item 3.5.1-83, 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).

3.5.2.1.7 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.5.1, item 3.5.1-93, addresses galvanized steel, aluminum or stainless steel support members, welds, bolted connections, and support anchorage to building structure 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 Inservice Inspection – IWF program to manage the aging effect for stainless steel structural bolting in bulk commodities exposed to an air-outdoor environment. The GALL Report recommends GALL Report AMP XI.S6, "Structures Monitoring," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S6 recommends using periodic visual inspections to manage the effects of aging. The GALL Report also recommends performing this visual inspection on a frequency not to exceed 5 years with provisions for more frequent inspections for SCs categorized as (a)(1) in accordance with 10 CFR 50.65. However, it is not clear whether the AMR item in LRA Table 3.5.2-4 addresses stainless steel structural bolting for ASME Code Section XI, Subsection IWF, component supports or for non-ASME supports as indicated by the reference to GALL Report item III.B2.TP-6. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.1.93-1 requesting that the applicant (1) clarify whether the stainless steel structural bolting is associated with ASME Code Section XI, Subsection IWF, components or non-ASME component supports and, and (2) if associated with non-ASME component supports, clarify if the stainless steel structural bolting is within the scope of the Inservice Inspection – IWF program.

In its response to RAI 3.5.1.93-1, dated December 7, 2016, the applicant stated that the LRA Table 3.5.2-4 AMR item for stainless steel structural bolting is associated with ASME Code Section XI, Subsection IWF, components. The applicant revised the LRA Table 3.5.2-4 item for the stainless steel structural bolting exposed to air – outdoor and subject to loss of material to reference Table 1 item 3.5.1-86, consistent with SRP-LR Table 3.5.1, item 86, and GALL Report items III.B.1.1.TP-235 and III.B.1.2.TP-235.

The staff evaluated the applicant's response and finds it acceptable because the applicant clarified that the stainless steel structural bolting is associated with ASME Code Section XI, Subsection IWF, components and revised the associated items in the LRA to be consistent with the GALL Report recommendation. The staff's concern described in RAI 3.5.1.93-1 is resolved. The associated item is reviewed as part of the AMR review for LRA Table 3.5.1, item 3.5.1-86.

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).

3.5.2.1.8 Loss of Material; Change in Material Properties Due to Weathering, Chemical Degradation, Repeated Wetting and Drying or Fungal Decay

LRA Table 3.5.1, item 3.5.1-62, addresses treated wooden piles exposed to soil, which will be managed for loss of material and changes in material properties. For the AMR items that cite generic note E, the LRA credits the Structures Monitoring program to manage the aging effect for wooden piles in soil. The GALL Report recommends GALL Report AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S7 recommends using periodic visual inspections to manage the effects of aging.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that the Structures Monitoring program proposes to manage the effects of aging for treated wooden piles through the use of periodic visual inspections; however, it was unclear to the staff how the piles will be inspected because they are

inaccessible beneath the fire pump house. By letter dated November 7, 2016, the staff issued RAI 3.5.1.62-1 requesting that the applicant explain how the Structures Monitoring program will manage the effects of aging on the inaccessible wooden piles so that the intended function will be maintained for the period of extended operation.

In its response dated December 7, 2016, the applicant stated that industry operating experience has shown that treated wooden piles are not subject to significant aging when driven into soil; therefore, degradation due to aging is not expected. The applicant further stated that although the piles will not be visible for inspection, the Structures Monitoring program will be able to detect potential degradation via inspections of the pump house, which would reveal indications of pile degradation (e.g., settlement of the pump house). The applicant also updated LRA Table 3.5.2-3 to remove reference to a GALL Report item and to revise the "Notes" column to include generic note G, which indicates the environment is not in GALL Report for this component and material.

The staff reviewed the applicant's response and noted that the fire pump house will be monitored for cracking due to settlement, which would be an indicator of wooden pile degradation. The staff verified that the pump house was included in the Structures Monitoring program and that the program monitors for settlement. The staff is unclear why the applicant revised LRA Table 3.5.2-3 to include note G since GALL Report item III.A6.TP-223 addresses wooden piles in soil; however, the staff finds the technical approach to aging management of the piles adequate regardless of the generic note G. The staff finds the applicant's response acceptable because the applicant is monitoring the pump house structure for indications of settlement, which would be an indicator of potential degradation to the wooden piles. The staff's concern described in RAI 3.5.1.62-1 is resolved.

Based on its review of components associated with item 3.5.1-62, for which the applicant cited generic note E and revised to generic note G, the staff finds the applicant's proposal to manage the effects of aging using the Structures Monitoring program acceptable because it will monitor the associated structure for signs of settlement, which would be an indicator of potential degradation in the wooden piles.

The staff concludes that for LRA item 3.5.1-62, 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).

3.5.2.1.9 Reduction or Loss of Isolation Function Due to Radiation Hardening, Temperature, Humidity, Sustained Vibratory Loading

LRA Table 3.5.1, item 3.5.1-94, addresses non-metallic vibration isolation elements exposed to air - indoor, uncontrolled or air - outdoor, which will be managed for reduction or loss of isolation function due to radiation hardening, temperature, humidity, and sustained vibratory loading. For the AMR item that cites generic note E, the LRA credits the Structures Monitoring program to manage the aging effect for elastomeric vibration isolators because, although these elastomeric vibration isolators are in scope, none are classified as ISI-IWF components. The GALL Report recommends GALL Report AMP XI.S3, ASME Section XI, Subsection IWF program, to provide reasonable assurance that this aging effect is adequately managed. GALL Report AMP XI.S3 recommends using periodic VT-3 examination supplemented by feel to detect hardening (if the vibration isolation function is suspect) to manage the effects of aging.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that the Structures Monitoring program contains an enhancement to manage cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening) for elastomeric vibration isolators. Based on its review of components associated with item 3.5.1-94 for which the applicant cited generic note E, the staff finds the applicant's proposal to manage the effects of aging using the enhanced Structures Monitoring program acceptable because WF3 does not have any elastomeric vibration isolation elements required to be inspected under the ASME Section XI, Subsection IWF program, and for other elastomeric vibration isolation elements in the scope of license renewal, the aging effects will be adequately managed by the Structures Monitoring program.

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

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 concrete dome, wall, basemat, ring girders, and buttresses exposed to soil. The criteria in SRP-LR Section 3.5.2.2.1.1 states that cracking and distortion due to increased stress levels could occur for concrete and steel containments. The SRP-LR also states that the existing program relies on ASME Section XI, Subsection IWL, to manage these aging effects.

The applicant stated that this item is not applicable because the WF3 steel containment structure's base foundation is integral with the base foundation of the Shield Building and thus inaccessible and exempted from inspections. LRA Section 3.5.2.2.1.1 states that the structure is a common reinforced concrete foundation structure for the NPIS, which is founded on a compacted shell filter blanket, which is supported by Pleistocene sediments. The applicant stated that although the ASME Section XI, Subsection IWL, Code Class CC-equivalent foundation is inaccessible, because it is integral with the Shield Building, the containment basemat will be managed for cracking and distortion due to increased stress levels from settlement, reduction of foundation strength, and cracking due to increased stress levels from settlement along with the Shield Building.

The staff noted in LRA Table 3.5.1, item 44, that the applicant proposes to manage Shield Building concrete for cracking and distortion due to increased stress levels from settlement using the Structures Monitoring program, consistent with the recommendations in the SRP-LR. The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff evaluated the applicant's claim and finds it acceptable because (1) the portion of the NPIS concrete foundation that applies to ASME Section XI, Subsection IWL, under the Code Class CC classification for containment basemat is not accessible and ASME Section XI, Subsection IWL, exempts inaccessible containment components from Code examinations; and (2) the applicant will be managing the effects of aging using the Structures Monitoring program, which will use visual inspections and trending where applicable to manage this aging effect for Shield Building concrete, which is integral with the containment basemat.

LRA Section 3.5.2.2.1.1, associated with LRA Table 3.5.1, item 3.5.1-2, addresses reduction of foundation strength and cracking due to increased stress levels from 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 states that reduction of foundation strength and cracking, due to differential settlement and erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. The SRP-LR also states that the existing program relies on the Structures Monitoring program to manage these aging effects.

The applicant stated that this item is not applicable because WF3 does not have a porous concrete subfoundation, nor does it rely on a dewatering system to control settlement. LRA Section 3.5.2.2.1.1 states that the containment structure's base foundation, which is integral with the Shield Building foundation, does not use a porous concrete subfoundation. The LRA

also stated that IN 97-11 did not identify WF3 as a plant susceptible to erosion of porous concrete subfoundations.

LRA Table 3.5.1, item 3.5.1-44, states that all concrete will be managed for this aging effect. The staff noted that Table 3.5.1, item 3.5.1-44 is associated with SRP-LR section 3.5.2.2.2.1, item 3, which states that Group 1-3 below-grade inaccessible concrete structures will be managed by the Structures Monitoring program. LRA Section 3.5.2.2.1.1 credits inspections of the Shield Building concrete foundation to manage this aging effect for the primary containment foundation, which is integral with the Shield Building foundation. However, the LRA did not contain any AMR items associated with GALL Report item III.A1.TP-30 for aging management of PWR Shield Building concrete exposed to soil. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.2.2.2.1-2 requesting that the applicant clarify whether Shield Building concrete exposed to soil would be managed for cracking and distortion due to increased stress levels from settlement, and also requested that the applicant reflect that in its AMRs. By letter dated December 7, 2016, the applicant responded that the Shield Building foundation (founded on a common mat with the primary containment foundation) is supported on the NPIS and that the NPIS is supported on a continuous reinforced concrete common foundation mat. The applicant stated that the foundation of the Shield Building does not come in contact with a soil environment. The staff reviewed the applicant's response and determined that because the Shield Building foundation is not in contact with soil, no AMR item associated with GALL Report item III.A1.TP-30 is needed. The staff's concern described in RAI 3.5.2.2.2.1-2 is resolved.

The staff evaluated the applicant's claim and finds it acceptable because these aging effects apply only to porous concrete subfoundations or applicants that use a de-watering system to control settlement. The staff verified in the FSAR that WF3 does not use a de-watering system to control containment settlement. In addition, the staff noted in IN 97-11 that a search of plant FSARs indicated that WF3 is not a plant that used a porous subfoundation; therefore, these aging effects do not apply. 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 is consistent with the GALL Report recommendation and is therefore acceptable. The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. In its review of the containment concrete foundation associated with item 3.5.1-1, 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 Structures Monitoring program is acceptable because the staff verified that the WF3 structures do not rely upon a de-watering system to control settlement, and the 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 SRP-LR Section 3.5.2.2.1.1 criteria. For those items associated with LRA Section 3.5.2.2.1.1, 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).

<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 elasticity due to elevated temperature in concrete: dome, wall, basemat, ring girders, buttresses, and/or fill annulus exposed to an air - indoor uncontrolled or air - outdoor environment. The criteria in SRP-LR Section 3.5.2.2.1.2 states that further evaluation of a

plant-specific AMP is recommended if any portion of the containment concrete components exceeds the specified temperature limits of 66 °C (150 °F) for general areas and 93 °C (200 °F) for local areas. The SRP-LR states that implementation of 10 CFR 50.55a and ASME Code Section XI, Subsection IWL, examinations would not be able to identify this aging effect. The SRP-LR also 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 the SCV is a steel structure with a common concrete basemat foundation with the Shield Building. The applicant stated that these aging effects and mechanisms are not applicable to the WF3 concrete foundation of the primary containment because the concrete foundation is not exposed to temperatures that exceed the thresholds of 66 °C (150 °F) for general areas and 93 °C (200 °F) for local areas.

The staff evaluated the applicant's claim and finds it acceptable because, based on its LRA review and FSAR Sections 3.8.3.1.2, 3.8.3.3.1, 3.8.5, and 9.4, the staff confirmed that (1) WF3 has a SCV, and (2) the in-scope concrete foundation of the containment is not exposed to temperatures beyond the GALL Report threshold limits for applicability of this aging effect; therefore, a plant-specific AMP is not required.

<u>Loss of Material Due to General, Pitting and Crevice Corrosion</u>.

<u>Item 1</u>. LRA Section 3.5.2.2.1.3, item 1, associated with LRA Table 3.5.1, item 3.5.1-5, addresses steel elements (inaccessible areas): liner; liner anchors; integral attachments exposed to air-indoor, uncontrolled, which will be managed for loss of material due to general, pitting, and crevice corrosion by the Containment Inservice Inspection – IWE program and the Containment Leak Rate program. The criteria in SRP-LR Section 3.5.2.2.1.3, item 1, states that loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments. 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 GALL Report states that additional plant-specific activities are warranted if loss of material due to corrosion is significant for inaccessible areas. In accordance with the GALL Report, corrosion is not significant if the following four conditions are satisfied:

(1) the concrete that is in contact with the embedded containment steel met the requirements of ACI 318 or 349, or use the guidance of ACI 201.2R

(2) the moisture barrier at the junction where the steel becomes embedded in concrete is subject to aging management activities in accordance with ASME Code Section XI, Subsection IWE, requirements

(3) the concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water to the surface of the containment shell

(4) borated water spills and water ponding are cleaned up or diverted to a sump in a timely manner

The applicant addressed the further evaluation criteria of the SRP-LR by stating that the SCV structure consists of a cylindrical wall, a hemispherical dome, and an ellipsoidal bottom liner plate encased in concrete. The applicant stated that there is a moisture barrier where the steel containment becomes embedded in the concrete floor. The applicant also stated that the SCV is inspected using "visual examination of the accessible interior and the exterior surfaces of the ASME class MC components, parts, and appurtenances of the [SCV] as well as visual inspection of the moisture barrier at the concrete to steel interface." Containment Inservice

Inspection – IWE program walkdowns identified six damaged locations of the containment inner moisture barrier between the containment vessel and the concrete floor on the ledge on elevation -4. The damage was identified to be both age-related degradation and mechanical damage to the moisture barrier. The LRA states that none of the affected areas showed signs of wetting and no corrosion of the containment vessel was noted. The areas were repaired under the corrective action program. The applicant stated that the continued monitoring of the SCV under the Containment Inservice Inspection – IWE program and the Containment Leak Rate program provides reasonable assurance that loss of material in inaccessible areas of containment is insignificant and will be detected prior to a loss of intended function.

In its review of the Containment Inservice Inspection – IWE program, the staff requested additional information regarding plant operating experience related to corrosion of the SCV (RAI B.1.6-4, dated September 15, 2016). The staff's review is documented in SER Section 3.0.3.2.4.

The staff's evaluation of the applicant's Containment Leak Rate program, Containment Inservice Inspection – IWE program, and Boric Acid Corrosion program are documented in SER Sections 3.0.3.1.3, 3.0.3.2.4, and 3.0.3.1.1, respectively. The staff noted that the Containment Inservice Inspection – IWE program and Containment Leak Rate program include periodic visual inspections of all accessible areas of the containment steel, with provisions to evaluate inaccessible areas of containment if conditions are found in accessible areas that may indicate there could be corrosion of inaccessible areas of containment carbon steel. The staff also noted that the Boric Acid Corrosion AMP addresses boric acid leaking on structural components. That program includes visual inspections of external surfaces, leak path identification, boric acid residue removal, degradation assessment, and followup inspections. In addition, the applicant's Containment Inservice Inspection – IWE program operating experience search did not identify instances of significant corrosion.

In its review of components associated with item 3.5.1-5, 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 Containment Inservice Inspection - IWE program and Containment Leak Rate program is acceptable because corrosion is not significant based on the criteria that (1) the concrete in contact with the embedded containment steel met the requirements of ACI 318 or 349, or use the guidance of ACI 201.2R; (2) the moisture barrier at the junction where the steel becomes embedded in concrete is subject to aging management activities in accordance with ASME Code Section XI, Subsection IWE, requirements carried out by the Containment Inservice Inspection – IWE program; (3) the concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell; (4) borated water spills and water ponding are cleaned up or diverted to a sump in a timely manner under the Boric Acid Corrosion program; and (5) there have not been instances of significant corrosion of accessible containment steel.

Item 2. LRA Section 3.5.2.2.1.3, item 2, associated with LRA Table 3.5.1, item 3.5.1-6, addresses loss of material due to general, pitting, and crevice corrosion in steel elements: torus shell exposed to air-indoor, uncontrolled, or treated water. The criteria in SRP-LR Section 3.5.2.2.1.3, item 2, states that loss of material due to general, pitting, and crevice corrosion could occur in the steel torus shell of Mark I containments. The applicant stated that this item is not applicable because WF3 is a PWR that uses a free-standing SCV and does not have a steel torus shell. The staff evaluated the applicant's claim and finds it acceptable because this further evaluation item only applies to BWRs with Mark I containments and WF3 is a PWR.

Item 3. LRA Section 3.5.2.2.1.3, item 3, associated with LRA Table 3.5.1, item 3.5.1-7, addresses loss of material due to general, pitting, and crevice corrosion in steel elements: torus ring girders; downcomers; and suppression chamber shell (interior surface) exposed to air-indoor, uncontrolled, or treated water. The criteria in SRP-LR Section 3.5.2.2.1.3, item 3, states 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 the interior surface of the suppression chamber shell of Mark III containments. The applicant stated that this item is not applicable because WF3 is a PWR that uses a free-standing SCV and therefore does not have these components. The staff evaluated the applicant's claim and finds it acceptable because this further evaluation item only applies to BWRs and WF3 is a PWR.

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, addresses loss of prestress due to relaxation; shrinkage; creep; elevated temperature in prestressing system and tendons exposed to air – indoor, uncontrolled or air - outdoor. The criteria in SRP-LR Section 3.5.2.2.1.4 states that loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments is a TLAA as defined in 10 CFR 54.3. The applicant stated that this item is not applicable because WF3 is a PWR with a SCV. The applicant also stated that there are no prestressed tendons associated with WF3 primary containment design. The staff evaluated the applicant's claim and finds it acceptable because it confirmed in the FSAR that the WF3 containment design is a free-standing SCV and does not use a concrete prestressing system.

Cumulative Fatigue Damage. LRA Section 3.5.2.2.1.5, associated with LRA Table 3.5.1, item 3.5.1-9, states that the TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1) and that the evaluation of this TLAA is addressed in Section 4.6, "Containment Liner Plates, Metal Containments, and Penetrations Fatigue Analysis." This is consistent with SRP-LR Section 3.5.2.2.1.5 and is, therefore, acceptable. The staff's evaluation of the TLAAs for WF3 metal containment and penetration bellows is documented in SER Section 4.6.

The applicant also stated that for item 3.5.1-9, the applicability is limited to the stainless steel penetration bellows exposed to air-indoor uncontrolled environment. The GALL Report item II.A3.C-13, associated with SRP-LR Table 3.5.1 item 9, addresses cumulative fatigue damage due to fatigue (if CLB fatigue analysis exists) in penetration sleeves and penetration bellows exposed to an uncontrolled air-indoor or air-outdoor environment. The staff noted that a search of the applicant's FSAR Section 3.8.2.1 identified different types of containment penetrations (i.e., Type I-VI), based on their design characteristics, that rely on different components (e.g., bellow, flued heads, sleeves) to maintain their intended function. Considering the different types of penetrations described in FSAR Section 3.8.2.1 and that no LRA Table 2 items corresponding to SRP-LR item 3.5.1-27 (for cracking due to cyclic loading if CLB fatigue analysis does not exist) have been identified in the LRA, the staff was not clear how penetration sleeves were dispositioned in the LRA and/or how they will be adequately managed for cumulative fatigue damage or cracking due to cyclic loading for the period of extended operation. By letter dated November 7, 2016, the staff issued RAI 3.5.2.2.1.5-1 requesting that the applicant (1) clarify how the penetration sleeves will be adequately managed for cumulative fatigue damage aging effect through the period of extended operation; otherwise, provide the technical basis for not addressing this aging effect for these component(s) in the LRA, and (2) provide justification for not including Table 2 AMR items for penetration sleeves to manage cracking due to cyclic loading.

In its response dated December 7, 2016, the applicant stated that the WF3 penetration sleeves are equipped with bellows to accommodate movement of the penetration piping and sleeves due to thermal expansion. The applicant also stated that this prevents or minimizes imposition of loads on the penetration sleeves due to differential movement between the SCV and the Shield Building; therefore, cumulative fatigue damage is not an AERM for the WF3 SCV penetration sleeves. The applicant further stated that for the same reason penetration sleeves were not referenced in LRA Table 3.5.2-1 for SRP-LR Table 3.5.1, item 27. The applicant revised the discussion provided in LRA Table 3.5.2-1, item 27, accordingly, and also indicated that applicable penetration components are nevertheless included in the Containment Inservice Inspection – IWE program and Containment Leak Rate program.

The staff finds the applicant's response acceptable because the applicant clarified that penetration sleeves at WF3 are equipped with bellows that accommodate differential movement due to loads such as thermal expansion and seismic without imposing undue stresses on these components; therefore, fatigue damage due to cyclic loading is not an AERM for penetration sleeves. The staff's concern described in RAI 3.5.2.2.1.5-1 is resolved and the staff's evaluation of the TLAA for WF3 penetration bellows is documented in SER Section 4.6.

<u>Cracking Due to Stress Corrosion Cracking</u>. LRA Section 3.5.2.2.1.6, associated with LRA table 3.5.1, item 3.5.1-10, addresses stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds exposed to plant indoor air, which will be managed for cracking due to SCC by the Containment Inservice Inspection – IWE program and Containment Leak Rate program. The 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 the ASME Code Section XI, Subsection IWE program and 10 CFR Part 50, Appendix J program to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect cracking due to SCC for stainless steel penetration components and dissimilar metal welds.

The applicant stated that SCC is not an applicable aging mechanism for the containment vessel carbon steel penetration sleeves, stainless steel penetration bellows, and dissimilar metal welds. The applicant indicated that the SCV and associated penetration sleeves are carbon steel and SCC is applicable to stainless steel only under certain conditions (i.e., combination of high tensile stress, corrosive environment, and susceptible material that are conducive to SCC). The applicant also stated that there are dissimilar metal welds associated with stainless steel bellows welded to carbon steel penetration sleeves. The applicant further indicated that SCC of these dissimilar metal welds is not considered applicable because SCC requires a concentration of chloride or sulfate contaminants, which are not normally present in significant quantities, as well as high stress and temperatures greater than 140 °F. In addition, the applicant indicated that since the TS limits the average air temperature inside the primary containment during normal plant operation to 120 °F, the environmental condition is not conducive to SCC and cracking of these penetration components due to SCC is not applicable.

The applicant also confirmed that its review of plant operating experience did not identify cracking of these containment penetration components, and containment pressure boundary functions have not been identified as a concern. The applicant stated that, nevertheless, the existing Containment Inservice Inspection – IWE program and the Containment Leak Rate program manage cracking due to SCC of stainless steel bellows and dissimilar metal welds.

The staff's evaluations of the applicant's Containment Inservice Inspection – IWE program and the Containment Leak Rate program are documented in SER Sections 3.0.3.2.4 and 3.0.3.1.3, respectively. In its review of components associated with LRA item 3.5.1-10, 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 Containment Inservice Inspection – IWE program and Containment Leak Rate program is acceptable because the applicant's evaluation confirmed that (1) the normal operating temperature inside the containment, which does not exceed 120 °F, is not conducive to SCC in these containment penetration components, (2) the environment without chemical contamination is not conducive to SCC in these components, (3) the applicant's review of plant operating experience confirms the absence of SCC in these components, and (4) the Containment Inservice Inspection – IWE program and Containment Leak Rate program will continue to confirm 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 and aging management evaluation meet the 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 (Spalling, Scaling) 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 components (e.g., dome, wall, basemat, ring girders, buttresses) of containment structures exposed to an air – outdoor or groundwater/soil environment. The criteria in SRP-LR Section 3.5.2.2.1.7 states that further evaluation of this aging effect is recommended for plants located in moderate to severe weathering conditions, defined as a weathering index greater than 100 day-inch/year in Figure 1, "Location of Weathering Regions," of ASTM C33-90, "Standard Specification for Concrete Aggregates." The applicant stated that this item is not applicable because WF3 is located in a "negligible" weathering region per Figure 1 of ASTM C33-90 and WF3 SCV concrete basemat structure is not exposed to temperatures below or equal to 0 °C (32 °F) at the durations necessary to cause freeze-thaw. The applicant further stated that the SCV concrete basemat is "below grade and protected from the outer environment by the shield building's base foundation and is not subject to freeze-thaw action."

The staff reviewed Figure 1 of ASTM C33-90 and confirmed that the WF3 location near Taft, Louisiana, is not in a "moderate" or "severe" weathering region. The staff confirmed that the WF3 location falls into the "negligible" weathering region where the climate condition is described in ASTM C33-90 as a climate in which concrete is rarely exposed to freezing in the presence of moisture. The staff also reviewed FSAR Section 3.8 and confirmed that the SCV has a concrete basemat below grade that is surrounded by the Shield Building and therefore is not exposed to the outside environment. The staff evaluated the applicant's non-applicability claim and finds it acceptable because (1) WF3 is not located in a moderate to severe weathering region, and (2) the below-grade location of the SCV concrete basemat surrounded by the Shield Building is not exposed to the environment required for this aging effect to occur.

<u>Cracking Due to Expansion from 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 cracking due to expansion from reaction with aggregate in inaccessible areas of concrete components (e.g., dome, wall, basemat) of the containment structure exposed to any environment. The criteria in SRP-LR

Section 3.5.2.2.1.8 states that cracking due to expansion from reaction with aggregates could occur in inaccessible areas of concrete elements of PWR steel containments, and that the GALL Report recommends further evaluation to determine if a plant-specific program is required to manage this aging effect. The applicant addressed the SRP-LR criteria by stating that the SCV structure has a foundation (basemat) that is integral with the foundation of the Shield Building and founded on a common concrete foundation structure for the NPIS. The applicant also stated that the listed aging effect for the SCV concrete basemat is addressed by the Structures Monitoring program through LRA Table 3.5.1, item 3.5.1-43, which addresses the aging effect for inaccessible concrete areas including the common NPIS concrete foundation, as discussed in LRA Section 3.5.2.2.2.1, item 2.

The staff's evaluation of LRA Table 3.5.1, item 3.5.1-43, and associated further evaluation in LRA Section 3.5.2.2.2.1, item 2, is documented in SER Section 3.5.2.2.2 under item 2 of the subsection entitled "Aging Management of Inaccessible Areas." The staff finds the applicant's approach to address the aging effect for SCV basemat foundation (AMR item 3.5.1-12) as part of AMR item 3.5.1-43, which manages the aging effects for inaccessible areas of the common basemat foundation of the NPIS by the Structures Monitoring program, acceptable because: (1) the staff confirmed from FSAR Section 3.8 that the SCV concrete foundation is integral with and part of the common basemat foundation of the Shield Building and NPIS; and (2) as concluded in the staff's evaluation of AMR item 3.5.1-43, the staff finds the Structures Monitoring program to be an adequate AMP to manage the associated aging effects.

<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 of the containment basemat 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. The criteria in SRP-LR Section 3.5.2.2.1.9 states that this aging effect could occur in inaccessible areas of concrete elements of PWR and BWR concrete and steel containments exposed to a water-flowing environment. The SRP-LR states that the GALL Report recommends further evaluation if leaching is observed in accessible areas that impact intended function(s). The GALL Report states that further evaluation is required to determine if a plant-specific AMP is needed to manage this aging effect for concrete in inaccessible areas. The GALL Report further states that a plant-specific AMP is not required if (1) there is evidence in the accessible areas of adjacent structures that the flowing water has not caused leaching and carbonation, or (2) 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 WF3 containment is a free-standing SCV structure with a base foundation (basemat) that is integral with the Shield Building's base foundation, which is part of the common concrete foundation structure for the NPIS. The applicant stated that the corresponding GALL Report AMR item related to SRP-LR Table 3.5-1, item 3.5.1-14, is associated with PWR/BWR concrete containments and the WF3 containment is a PWR steel containment structure, and is therefore not applicable. The applicant also stated that the WF3 SCV concrete basemat is protected from the external environment by the Shield Building foundation and, because it is inaccessible, it is therefore exempted from inspection and the ASME Code Section XI, Subsection IWL AMP does not apply. However, regarding AMR item 3.5.1-13, the applicant stated that the listed aging effects will be addressed under AMR item 3.5.1-47 for the safety-related Shield Building concrete foundation and common concrete foundation structure of the NPIS as discussed in

LRA Section 3.5.2.2.2.1, item 4. The applicant stated that the Structures Monitoring program will manage the listed aging effects under AMR item 3.5.1-47.

The staff reviewed FSAR Section 3.8 and confirmed that the WF3 containment is a SCV that is surrounded by a reinforced concrete Shield Building and supported on a common concrete foundation (basemat) with the Shield Building and NPIS. Therefore, the staff finds the applicant's claim that item 3.5.1-14 is not applicable acceptable because this item is only applicable to concrete containments.

With regard to AMR item 3.5.1-13, which the applicant claimed to be addressed by item 3.5.1-47, based on its LRA review, it is apparent to the staff that the applicant has determined that a plant-specific AMP is not necessary to manage the listed aging effect. However, the staff noted that the LRA did not provide an adequate basis to support this determination, nor did it provide information to address the GALL Report's recommended criteria (1) and (2) discussed above. In addition, the LRA does not provide information on operating experience at WF3 about the aging effects of leaching and carbonation. The staff also noted that AMR item 3.5.1-47 is not listed in any LRA AMR Table 2s. Therefore, by letters dated November 7, 2016, and December 19, 2016, the staff issued RAIs 3.5.2.2.2.1-1 and 3.5.2.2.2.1-1a, respectively, requesting that the applicant demonstrate whether a plant-specific program is necessary to provide justification for not including item 3.5.1-47 as a Table 2 AMR item in LRA Tables 3.5.2-1 through 3.5.2-4, and to demonstrate that the listed aging effects will be adequately managed during the period of extended operation. The staff's concerns associated with RAIs 3.5.2.2.2.1-1 and 3.5.2.2.2.1-1a were addressed in the applicant's responses dated December 7, 2016, and February 1, 2017, respectively, and resolved. A detailed discussion of their resolution is provided in SER Section 3.5.2.2.2, item 4, under the title "Aging Management of Inaccessible Areas," which documents the staff evaluation of the further evaluation associated with AMR item 3.5.1-47. The staff notes that the applicant's response to RAI 3.5.2.2.2.1-1a revised LRA Table 3.5.2-2 "Nuclear Plant Island Structure" to include a new AMR item corresponding to LRA Table 3.5.1, item 3.5.1-47, which covers inaccessible areas of the NPIS common basemat foundation, part of which forms the SCV basemat foundation. The staff finds the applicant's approach to address the aging effects for the SCV basemat foundation (AMR item 3.5.1-13) as part of AMR item 3.5.1-47, which manages the aging effects for inaccessible areas of the common basemat foundation of the NPIS by the Structures Monitoring program, acceptable because: (1) the staff confirmed from FSAR Section 3.8 that the SCV concrete foundation is integral with and part of the common basemat foundation of the Shield Building and NPIS; and (2) as concluded in the staff's evaluation of AMR item 3.5.1-47, documented in SER Section 3.5.2.2.2, item 4, the staff finds the Structures Monitoring program to be an adequate AMP to manage the associated aging effects.

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:

<u>Aging Management of Inaccessible Areas</u>. 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 1-3, 5, and 7-9 structures for aging effects as below.

Item 1. LRA Section 3.5.2.2.2.1, item 1, associated with LRA Table 3.5.1, item 3.5.1-42, addresses loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures exposed to air-outdoor environment. The criteria in SRP-LR Section 3.5.2.2.2.1, item 1, states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur for below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 exposed to air-outdoor, and that the GALL Report recommends further evaluation 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 subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant stated that this item is not applicable because WF3 is located in a "negligible" weathering region per Figure 1 of ASTM C33-90, and the Groups 1-3, 5, and 7-9 structures subject to air-outdoor environment are not exposed to temperatures at or below 32 °F of sufficient duration that would cause freeze-thaw aging effects. The applicant also stated that air entraining admixture was used in the concrete and the total air content generally ranged between 3.5 and 6.5 percent by volume, and a review of the WF3 corrective action program did not find documented evidence of freeze-thaw degradation in exterior concrete structures. The staff evaluated the applicant's claim that LRA Table 3.5.1, item 3.5.1-42, is not applicable, and finds it acceptable because the staff confirmed from Figure 1 of ASTM C33 that the WF3 site is not located in a region with moderate to severe weathering conditions, the existing concrete had entrained air content in the acceptable range between 3 and 8 percent, and there is no operating experience of freeze-thaw aging effects in areas of concrete structures exposed to outdoor air.

Item 2. LRA Section 3.5.2.2.2.1, item 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 Groups 1-5 and 7-9. The criteria in SRP-LR Section 3.5.2.2.2.1, item 2, states that further evaluation is recommended to determine if 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 the Groups 1-5 and 7-9 structures at WF3 are designed and constructed in accordance with ACI 318 (1963 and/or 1971 edition), with the concrete mix using Portland cement conforming to ASTM C150, Type II, and aggregates conforming to ASTM C33. The applicant also stated that the concrete materials used in WF3 structures were specifically investigated, tested, and examined in accordance with pertinent ASTM standards, and that WF3 has not identified operating experience for this aging effect. The applicant further stated that based on ongoing industry operating experience, cracking due to expansion and reaction with aggregates in below-grade inaccessible concrete areas of Groups 1-5 and 7-9 structures will be managed using the Structures Monitoring program.

In its review of components associated with item 3.5.1-43, the staff evaluated the applicant's proposal that cracking due to reaction with aggregates will be managed in inaccessible concrete areas by the Structures Monitoring program. The staff noted that the applicant cited generic note E in the Table 2s for components associated with item 3.5.1-43 because the GALL Report recommends further evaluation to determine if a plant-specific program is needed to manage the aging effect. The staff also noted that LRA Table 3.5.1, item 3.5.1-54 (All groups except 6:

concrete (accessible areas): all), indicated that this aging effect will be managed for accessible concrete using the Structures Monitoring program, which is consistent with the GALL Report recommendation for accessible areas. The staff further noted that the LRA AMP B.1.38, "Structures Monitoring," with enhancements will be consistent with the GALL Report AMP XI.S6. This indicates that the applicant's AMP requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas, and that the AMP will also examine portions of below-grade concrete when excavated for any reason. Additionally, the staff noted from FSAR Sections 3.8.3.6.1, 3.8.4.6.1, and 3.8.5.6 that the fine and coarse aggregates used at WF3 were sampled, tested, and conformed to ASTM C33-71, including the ASTM C289 testing of aggregates for potential reactivity.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that a plant-specific AMP is not necessary because the WF3 concrete structures were constructed to ACI and ASTM standards that minimize the possibility of cracking due to alkali-aggregate reaction, and review of the operating experience did not identify the aging effect or mechanism in accessible portions of WF3 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. 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 the applicant's proposal to manage the effects of aging using the Structures Monitoring program is acceptable because (1) the program will effectively manage cracking from expansion due to reaction with aggregates by performing periodic visual inspections of accessible areas of structures of all groups except 6, 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, and (3) a plant-specific program is unnecessary.

Based on the evaluation provided and program identified, the staff determines that the applicant's program meets 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 and LRA item 3.5.1-43, 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, item 3, associated with LRA Table 3.5.1, item 3.5.1-44, addresses below-grade inaccessible concrete areas of structures exposed to soil or flowing water that will be managed for cracking and distortion due to increased stress levels from settlement (all Groups), and reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation (Groups 1-3, 5-9) by the Structures Monitoring program. The criteria in SRP-LR Section 3.5.2.2.2.1, item 3, states that cracking and distortion due to increased stress levels from settlement (all Groups) and reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundation (Groups 1-3, 5-9) could occur in below-grade inaccessible concrete areas exposed to soil or flowing water, and that further evaluation is necessary if a de-watering system is relied upon to control settlement to verify continued functioning of the de-watering system through the period of extended operation. The applicant addressed the further evaluation criteria of the SRP-LR for item 3.5.1-44 by stating that structures at WF3 do not rely upon a de-watering system to control settlement. The applicant further stated that cracking and

distortion due to increased stress levels from settlement is an applicable aging effect for the safety-related NPIS with a common rigid basemat (founded on a compacted shell filter blanket), and the Turbine Building and other nonsafety-related concrete structures (founded on compacted backfill or soil), and will be managed by the Structures Monitoring program (by evaluating the aging effects in inaccessible concrete areas using conditions observed from visual inspections of accessible areas). The applicant also addressed the further evaluation criteria of the SRP-LR for item 3.5.1-46 by stating that reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations is not an applicable aging effect for WF3 inaccessible concrete structures because WF3 structures do not use a porous concrete subfoundation in addition to not relying upon a de-watering system to control settlement.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff reviewed FSAR Sections 2.5.4 and 3.8.5, and verified that de-watering systems are not relied upon to control settlement at WF3 and, therefore, LRA Table 3.5.1, items 3.5.1-44 and 3.5.1-46, do not need further evaluation. The staff noted that the WF3 structures are not founded on porous concrete subfoundations but generally founded on grouted bedrock or crushed rock. The staff evaluated the applicant's claim that the aging effect for LRA Table 3.5.1, item 3.5.1-46, is not applicable and finds it acceptable because the staff verified that the WF3 concrete structures are not founded on porous concrete subfoundation and do not rely upon a de-watering 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 is therefore acceptable. In its review of components associated with item 3.5.1-44, 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 Structures Monitoring program is acceptable because the staff verified that the WF3 structures do not rely upon a de-watering system to control settlement, and the 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, item 4, associated with LRA Table 3.5.1, item 3.5.1-47, addresses below-grade inaccessible concrete areas of Groups 1- 5 and 7-9 structures exposed to groundwater (considered equivalent 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 states that increase 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 1-5 and 7-9 concrete structures exposed to a water-flowing environment. The SRP-LR also states that further evaluation is required if leaching is observed in accessible areas that impact intended functions. The related review procedure in SRP-LR 3.5.3.2.2.1, item 4, and the GALL Report AMR items associated with SRP-LR Table 3.5.1, item 3.5.1-47, also state that further evaluation is required to determine if a plant-specific AMP is needed to manage an increase 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) 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 this is an applicable aging effect for the below-grade inaccessible concrete areas at WF3, which are exposed to groundwater, considered as equivalent to a flowing water environment. The applicant further stated that WF3 Groups 1- 5 and 7-9 concrete structures are designed and constructed in accordance with ACI 318 (1963 and/or 1971 editions) using materials conforming to ACI and ASTM standards (e.g., ASTM C150, Type II for cement and ASTM C33 for aggregate) to produce dense, well-cured, durable concrete having low permeability consistent with the guidance and recommendations in ACI 201.2R-77.

In its review of LRA AMP B.1.38 "Structures Monitoring," the staff noted that the program does not include any plant-specific enhancement to specifically address the aging effects of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation for inaccessible areas. In addition, the further evaluation in LRA Section 3.5.2.2.2.1, item 4, did not include discussion related to the WF3 operating experience with regard to the aging effects of leaching and carbonation at WF3. The staff determined that the applicant's further evaluation was contrary to the criteria in the SRP-LR because the applicant did not state it would be using a plant-specific program (or a plant-specific enhancement to the Structures Monitoring program) and there is no discussion of (1) an evaluation to determine whether there is evidence in the accessible areas that the flowing water has not caused leaching and carbonation, or (2) an evaluation that determined that the observed leaching of calcium hydroxide and carbonation in accessible areas has no impact on the intended function of the concrete structure. Therefore, the staff finds that sufficient information is not provided in the LRA further evaluation section for the staff to determine if the applicant has met the further evaluation criteria of SRP-LR stated above with regard to whether a plant-specific program is needed to manage the aging effects. Additionally, in its review of components associated with item 3.5.1-47, the staff also finds that there are no Table 2 AMR items identified in LRA Tables 3.5.2-1 through 3.5.2-4 for LRA Table 3.5.1, item 3.5.1-47 (and corresponding GALL Report items), which would indicate that the aging effects will be appropriately managed for the applicable components. Therefore, by letter dated November 7, 2016, the staff issued RAI 3.5.2.2.2.1-1 requesting that the applicant justify whether a plant-specific program is necessary by describing if WF3 has observed leaching of calcium hydroxide and carbonation in accessible concrete areas subject to an "exposed to fluid environment," which by definition in LRA Table 3.0-2 includes the applicable GALL Report "water-flowing" environment, and if so its impact on intended functions. The staff also requested that the applicant provide justification for not including Table 2 AMR items in LRA Tables 3.5.2-1 through 3.5.2-4 for LRA Table 3.5.1, item 3.5.1-47 (and corresponding GALL Report items), which the applicant claimed to be applicable.

In its response letter dated December 7, 2016, the applicant stated that a 2011 report documented a condition involving mineral deposits on the surface of a concrete ceiling (not exposed to groundwater environment) in the Reactor Auxiliary Building, which was identified during inspections performed under the Structures Monitoring program and noted as potential leaching of calcium hydroxide. The applicant also stated that the condition was evaluated and determined to have no impact on the structure's intended function, and no indication of leaching was observed in the next inspection of the area. The applicant further stated that the operating experience at WF3 has not identified leaching of calcium hydroxide and carbonation for

accessible structures exposed to groundwater or flowing water environments, and that there is reasonable assurance that structural integrity of concrete in inaccessible areas is also not impacted. The applicant, therefore, concluded that leaching of calcium hydroxide and carbonation is not an AERM for WF3 structures exposed to a groundwater/soil environment. The applicant also revised LRA Section 3.5.2.2.2.1 accordingly.

The staff finds that the basis provided in the applicant's response to request 1 of RAI 3.5.2.2.2.1-1 is adequate to satisfy the further evaluation criteria of SRP-LR Section 3.5.2.2.2.1, item 4, for SRP-LR Table 3.5.1, item 47 (for Group 1-5, 7-9 structures), and the corresponding GALL Report AMR items (e.g., item III.A3.TP-67) to support a conclusion that a plant-specific AMP or enhancement is not necessary to manage the related aging effects. This is because the WF3 operating experience has not identified leaching of calcium hydroxide and carbonation in accessible areas of structural components exposed to a groundwater/soil environment; and the applicant's determination that the operating experience of leaching identified in the ceiling of the Reactor Auxiliary Building did not have an impact on intended function. However, the response does not support the applicant's conclusion that the aging effects of increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide and carbonation is not an AERM for above- and below-grade inaccessible areas of Groups 1-5, 7-9 concrete structures subject to the GALL Report "water-flowing" environment [exposed to fluid environment in LRA Table 3.0-2]. The staff finds that the aging effect corresponding to SRP-LR Table 3.5.1, item 47, is still applicable because the applicable component(s), material, and environment exists at WF3, and therefore should be managed consistent with the provisions in the corresponding GALL Report AMR items. The LRA item 3.5.1-47, therefore, should remain applicable to WF3; however, there are no LRA Table 2 AMR items included in the LRA that correspond to SRP-LR Table 3.5.1, item 47, to indicate that the aging effects will be adequately managed during the period of extended operation. Further, LRA Table 3.5.1, item 3.5.1-47, continues to state that the AMR item is consistent with the GALL Report, and the Structures Monitoring program manages the listed aging effect, which appears to be a reasonable conclusion. However, the staff finds the statement to be contradictory to the conclusion in the RAI response. Therefore, by letter dated December 19, 2016, the staff issued followup RAI 3.5.2.2.2.1-1a requesting that the applicant provide information to demonstrate that the aging effects corresponding to SRP-LR Table 3.5.1, item 47 (and item 13 applicable to containment basemat for the same aging effect), and respective GALL Report AMR items, will be adequately managed during the period of extended operation consistent with the requirements of 10 CFR 54.21(a)(3); or, alternately provide technical justification for not including Table 2 AMR items in LRA Tables 3.5.2-1 through 3.5.2-4 (as applicable) for LRA Table 3.5.1, item 3.5.1-47 and item 3.5.1-13 (and corresponding GALL Report items), which address aging effects that may require management at WF3 during the period of extended operation.

In its response to RAI 3.5.2.2.2.1-1a by letter dated February 1, 2017, the applicant clarified that the aging effects due to leaching and carbonation in below-grade inaccessible areas subject to a water-flowing environment will be adequately managed by the Structures Monitoring program, and revised the further evaluation in LRA Section 3.5.2.2.2.1, item 4, accordingly. The applicant also revised LRA Table 3.5.1, item 3.51-13, to state that the listed aging effect is addressed by item 3.5.1-47, and revised LRA Tables 3.5.2-2 and 3.5.2-3 to add applicable GALL Report AMR items corresponding to LRA item 3.5.1-47 with generic note E. The staff finds the response acceptable because the applicant clarified that despite no operating experience in accessible areas at WF3, the subject aging effects in inaccessible areas will be managed by the Structures Monitoring program. Additionally, the applicant revised LRA Section 3.5.2.2.2.1, item 4, and added corresponding Table 2 AMR items to indicate that the aging effects due to leaching and

carbonation will be managed. The staff's concerns in RAI 3.5.2.2.2.1-1a and RAI 3.5.2.2.2.1-1 are thus resolved.

The staff noted that LRA Table 3.5.1, item 3.5.1-63 (Groups 1- 5 and 7-9: concrete (accessible areas): exterior above- and below-grade; foundation), indicated that this aging effect will be managed for accessible concrete using the Structures Monitoring program, which is consistent with the GALL Report recommendation for accessible areas. The staff further noted that the LRA AMP B.1.38 "Structures Monitoring" with enhancements will be consistent with the GALL Report AMP XI.S6. This indicates that the applicant's AMP requires evaluation of the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in degradation to such inaccessible areas, and that the AMP will also examine portions of below-grade concrete when excavated for any reason.

The staff's evaluation of the applicant's Structures Monitoring program is documented in SER Section 3.0.3.2.20. The staff noted that the applicant's program includes provisions to evaluate inaccessible concrete areas based on conditions found in accessible areas, and opportunistic inspection of inaccessible areas when excavated for any reason. The staff noted that the applicant cited generic note E in the Table 2s for components associated with item 3.5.1-47 because the GALL Report recommends further evaluation to determine if a plant-specific program is needed to manage the aging effect. 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 the applicant's proposal to manage the aging effects using the Structures Monitoring program is acceptable because (1) the program will manage the aging effects through visual inspection of accessible areas and exposed portions of inaccessible areas when excavated for any reason, (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, and (3) a plant-specific program is not necessary due to lack of significant operating experience of leaching or carbonation at WF3.

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, item 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 of Concrete Structures 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 elasticity in Groups 1 through 5 concrete structures exposed to elevated temperatures in an air-indoor uncontrolled environment. The criteria in SRP-LR Section 3.5.2.2.2.2 states that further evaluation of a plant-specific program is recommended for Group 1-5 concrete structures exposed to a general area temperature greater than 66 °C (150 °F) and local area temperature greater than 93 °C (200 °F). The SRP-LR also states that temperatures above the limits may be allowed if tests and/or calculations are provided to evaluate the reduction in strength and modulus of elasticity and these reductions are applied to the design calculations. The applicant stated that this item is not applicable because WF3 Group 1-5 structures are maintained below a bulk average temperature of 66 °C (150 °F) for general areas and below 93 °C (200 °F) in local areas. The applicant stated that plant cooling systems maintain the general area temperature under 66 °C (150 °F). The applicant also stated that for local areas of concrete at penetrations, through which process piping with pipe temperature greater than 93 °C (200 °F) are routed, guard pipes and insulation of the

associated piping are in place to minimize the heat transfer from the process pipe to the exterior environment, thereby resulting in local area temperatures not exceeding 93 °C (200 °F) on the concrete surface. The staff reviewed the LRA and FSAR Subsections 3.8.3.1.2, 3.8.3.3.1, 3.8.4.3, 6.2.2, 6.2.1.1.2, 9.4, and FSAR Table 9.4-1. Based on its LRA and FSAR reviews, the staff notes that cooling systems at WF3 maintain the general area temperatures of Group 1-5 concrete structures below the threshold limit of 66 °C (150 °F) during normal operations, and the use of guard pipes and insulation provide a reduction in thermal stresses in the concrete below the threshold limit of 93 °C (200 °F) during normal operations. The staff also notes, based on its review of LRA Table 3.5.2-4, "Bulk Commodities," that the aging effect of reduction of thermal insulation resistance for insulation components will be managed by the External Surfaces Monitoring program, which is consistent with the recommendations in the GALL Report. The staff evaluated the applicant's non-applicability claim and finds it acceptable because: (1) WF3 cooling systems maintain general area concrete temperatures below 66 °C (150 °F), (2) localized area concrete temperatures are maintained below 93 °C (200 °F) through the use of guard pipes and thermal insulation, and (3) the reduction of thermal insulation is age-managed consistent with the GALL Report recommendations; therefore, a plant-specific AMP to manage this aging effect is not required.

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.3, which addresses further evaluations recommended in SRP-LR Section 3.5.2.2.2.3 related to aging management of inaccessible areas for Group 6 structures for aging effects as below.

Item 1. LRA Section 3.5.2.2.2.3, item 1, associated with LRA Table 3.5.1, item 3.5.1-49, addresses inaccessible concrete areas of Group 6 structures exposed to outdoor air. The criteria in SRP-LR Section 3.5.2.2.2.3, item 1, states 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 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 subsequent inspection of accessible areas did not exhibit degradation related to freeze-thaw. The applicant stated that this item is not applicable because the WF3 site configuration does not have Group 6 structures. The staff evaluated the applicant's claim that LRA Table 3.5.1, item 3.5.1-49, is not applicable and finds it acceptable because WF3 has not classified any structures as Group 6 and additionally, as indicated in SER Section 3.5.2.2.2, item 1, under "Aging Management of Inaccessible Areas," the WF3 site is not located in a region with moderate to severe weathering conditions in which the aging effect occurs.

Item 2. LRA Section 3.5.2.2.2.3, item 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 states that further evaluation is recommended to determine if a plant-specific AMP is required to manage this aging effect. The corresponding SRP-LR review procedure 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 stated that this item is not applicable because the WF3 site configuration does not have Group 6 structures. The staff evaluated the applicant's claim that LRA Table 3.5.1, item 3.5.1-50, is not applicable and finds it acceptable because WF3 has not classified any

structures as Group 6 at WF3. Additionally, as indicated in SER Section 3.5.2.2.2, item 2, under "Aging Management of Inaccessible Areas," below-grade inaccessible areas for which this aging effect is applicable will be adequately managed at WF3 as part of Group 1-5 and Group 7-9 structures.

Item 3. LRA Section 3.5.2.2.2.3, item 3, associated with LRA Table 3.5.1, item 3.5.1-51, addresses inaccessible concrete areas of Groups 6 structures for increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation. The criteria in SRP-LR Section 3.5.2.2.2.3, item 3, states that increase 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 applicant stated that this item is not applicable because the WF3 site configuration does not have Group 6 structures. The staff evaluated the applicant's claim that LRA Table 3.5.1, item 3.5.1-51, is not applicable and finds it acceptable because WF3 has not classified any structures as Group 6 at WF3. Additionally, as indicated in SER Section 3.5.2.2.2, item 4, under "Aging Management of Inaccessible Areas," below-grade inaccessible areas for which this aging effect is applicable will be adequately managed at WF3 as part of Group 1-5 and Group 7-9 structures.

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 Groups 7 and 8 tank liners exposed to water-standing. The criteria in SRP-LR Section 3.5.2.2.2.4 states that cracking due to SCC and loss of material due to pitting and crevice corrosion could occur in stainless steel Groups 7 and 8 tank liners exposed to standing water. The SRP also states that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects. The applicant stated that this item is not applicable because no tanks with stainless steel liners are included in the structural scope of license renewal. The staff evaluated the applicant's claim and finds it acceptable because the component is not in scope for license renewal; therefore, it does not require aging management.

Cumulative Fatigue Damage. LRA Section 3.5.2.2.2.5, associated with LRA Table 3.5.1, item 3.5.1-53, states that no fatigue analyses were identified for component support members, welds, and support anchorage to building structure for Groups B1.1, B1.2, and B1.3. The staff notes that analyses that are not included in the CLB do not conform to the definition of a TLAA in 10 CFR 54.3(a). Therefore, the applicant's basis in LRA Section 3.5.2.2.2.5 is consistent with SRP-LR Section 3.5.2.2.2.5 and is, therefore, acceptable.

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 Report

In LRA Tables 3.5.2-1 through 3.5.2-4, 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 3.5.2-4, 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 Reactor 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 Reactor 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 Reactor Building component groups are consistent with the GALL Report.

3.5.2.3.2 Nuclear Plant Island Structure – 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 NPIS 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 NPIS component groups are consistent with the GALL Report.

3.5.2.3.3 Turbine Building and Other Structures – 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 Turbine Building and other structures component groups.

<u>Carbon Steel Crane Rails and Structural Girders Exposed to Air-Outdoor</u>. In LRA Table 3.5.2-3, the applicant stated that steel crane rails and structural girders exposed to air-indoor will be managed for loss of material by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program. The AMR item cites generic note G.

During the onsite audit walkdown, the staff noted that the Turbine Building crane is located outdoors; therefore, the staff established that the environment for the Turbine Building crane AMR item should be air-outdoor instead of the incorrect entry listing of air-indoor. Hence the AERM for this component is loss of material and the MEAP is steel, air – outdoor, loss of material, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program.

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 (i) NUREG–0612, "Control of Heavy Loads at Nuclear Power Plants" (ADAMS Accession No. ML070250180), which references periodic inspection of large cranes using as examples those used in shipyards, located outdoors; and (ii) ASME/ANSI Standard B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)," which discusses crane design factors set by the ASME B30 Standards Committee addressing environmental conditions causing corrosion or wear of components exposed to air-indoor and air-outdoor environments; 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 Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program is documented in SER Section 3.0.3.2.12. Loss of material due to general corrosion and wear is an AERM for carbon steel in outdoor environments. The staff finds the applicant's proposal to manage this aging effect using the proposed enhanced Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program acceptable because the LRA AMP references the same documents (i.e., NUREG–0612 and ASME B30.2) as those in GALL Report AMP XI.M23 for managing the effects of aging for loss of material due to general corrosion and wear.

<u>Carbon Steel Piles Exposed to Soil</u>. In LRA Table 3.5.2-3 the applicant stated that for carbon steel piles exposed to soil, loss of material due to corrosion is not applicable and no AMP is proposed. The AMR item cites generic note I and a plant-specific note 501, which states:

> Steel piles driven into undisturbed soils are unaffected by corrosion. Where steel piles are driven into disturbed soils, operating experience has shown that only minor to moderate corrosion has occurred that would not significantly affect the performance of the component intended function during the license renewal term. The steel piles are steel casings used as forms for the concrete inside the steel piles. The concrete inside the steel casing is not susceptible to degradation that could impair the ability of the concrete to perform its intended function. Therefore, no aging management is required.

The staff reviewed the associated items in the LRA to confirm that this aging effect is not applicable for this component, material, and environment combination. However, the staff noted a discrepancy between the information provided above and that in LRA Table 3.5.1, item 3.5.1-79. Consistent with the SRP-LR, item 3.5.1-79 addresses loss of material due to corrosion for "steel components: piles," but states that WF3 has no steel piles subject to the listed aging effect. The staff also noted a discrepancy between LRA Table 3.5.1, item 3.5.1-79, and LRA Table 2.4-3 regarding the intended function of concrete-infilled steel pipe piles to support 10 CFR 54.4(a)(3) equipment. Plant-specific note 501 associated with LRA Table 3.5.2-3 identifies the steel piles as having minor to moderate corrosion if driven in disturbed soil; otherwise, they are not subject to loss of material. The LRA dispositions the steel

piles as not requiring aging management for loss of material because there is no significant corrosion for steel piles driven in undisturbed soil, where the steel pipe casing was used as formwork for the infilled concrete. The applicant said that for this reason, the steel piles are not susceptible to degradation, but it did not provide a technical basis for this conclusion (e.g., analysis of degradation rate and expected degradation during the period of extended operation). This resulted in the issuance of RAI 3.5.1.79-1 relevant to steel pipe piles and LRA item 3.5.1-79. The RAI addresses inconsistencies in the aforementioned tables and whether the steel piles (casings) used as forms for the infilled concrete are subject to management for the aging effect of loss of material. The staff's review, evaluation, and acceptance of the applicant's response to RAI 3.5.1.79-1 (which concluded that it is not necessary to manage the loss of material aging effect for this component, material, and environment combination) is documented in SER Section 3.5.2.1.1.

3.5.2.3.4 Bulk Commodities – 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 bulk commodities component groups.

<u>Cerablanket, Kaowool Blanket, HEMYC, Siltemp Fibersil Cloth, Silicone Elastomers, Thermo-lag, Elastomer Fire Stops/Wrap Exposed to Uncontrolled Indoor Air</u>. In LRA Table 3.5.2-4, the applicant stated that Cerablanket™, Kaowool® blanket, HEMYC, Siltemp fibersil cloth, silicone elastomers, Thermo-lag, and elastomer fire barriers exposed to uncontrolled indoor air will be managed for loss of material, change in material properties, cracking/delamination, and separation by the Fire Protection program. The AMR items cite generic note J, which states that "[n]either the component nor the material and environment combination is evaluated in NUREG–1801."

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 the GALL Report does not include AMR items for non-metallic fire barriers (e.g., fire stops and fire wrap), the GALL Report AMP XI.M26, "Fire Protection," includes aging management for other fire resistance materials (e.g., flamastic, 3M™ fire wrapping, spray-on fire proofing material, intumescent coating) within the "scope of program." The 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. 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 Fire Protection program is documented in SER Section 3.0.3.2.8. 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 (RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 2, Section 1.7.4, *Inspection*) and nuclear industry practice (as documented in NUREG–1552, "Fire Barrier Penetration Seals in Nuclear Power Plants," Supplement 1) of ensuring the integrity of fire

barriers through inspections. It is also consistent with industry practice of maintaining material integrity and dimensional stability as a means to assuring material design performance.[1]

Fiberglass and Calcium Silicate Insulation Components Exposed to Air-Indoor Uncontrolled. In LRA Table 3.5.2-4, the applicant stated that fiberglass and calcium silicate insulation components (e.g., jacketing, wire mesh, tie wires, straps) exposed to air-indoor uncontrolled environment will be managed for loss of material and changes in material properties by the Structures Monitoring program. The AMR item cites generic note J. The staff notes that another AMR item in LRA Table 3.5.2-4, associated with Table 1 item 3.4.1-64, manages the aging effect of reduced thermal insulation resistance due to moisture intrusion for this component, material, and environment combination using the External Surfaces Monitoring program.

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 fiberglass and calcium silicate insulation are commonly used at nuclear power plants, in a dry environment, with low potential for water leakage, spray, or condensation. Fiberglass and calcium silicate are expected to be inert to environmental effects. However, the staff also noted that both fiberglass and calcium silicate insulation have potential for prolonged retention of any moisture to which they are exposed, and prolonged exposure to moisture may increase thermal conductivity, thereby degrading the insulating capacity. The staff further noted that water intrusion or wetting of enclosed calcium silicate or fiberglass insulation can be prevented by ensuring proper installation of the insulation and by detecting degradation in the protective insulation jacketing including overlapping joints. LRA Section B.1.10, "External Surfaces Monitoring," states that insulation is installed in accordance with a plant-specific procedure that contains configuration features such as overlap and location of seams, and describes the inspection parameters included to manage these aging effects. Based on its review of the aging effects proposed by the applicant, 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 3.0.3.2.20. The staff notes 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 finds the applicant's proposal to manage the effects of aging, associated with structural support, using the Structures Monitoring program acceptable because (1) the scope of the Structures Monitoring program has been enhanced to include inspection of these components; (2) the calcium silicate, and fiberglass insulation is protected by jacketing, and would protect moisture from entering the insulation; and (3) periodic visual inspections performed under the Structures Monitoring program will identify any loss of material and changes in mechanical properties for the insulation components (e.g., jacketing, wire mesh, tie wires, straps).

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

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[1] Guyer, E.C., editor in chief, *the Handbook of Applied Thermal Design*, Part 3, Chapter 1, "Characteristics and Application of Thermal Insulation," Hamilton Printing Company, Castleton, NY, 1999.

so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls Components

This section of the SER documents the staff's review of the applicant's AMR results for the following electrical and instrumentation and controls commodity groups:

- High-voltage insulators
- Non-EQ insulated cables and connections circuits
- Metal-enclosed bus
- Switchyard bus and connections
- Transmission conductors and connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical components commodity groups. LRA Table 3.6.1, "Summary of Aging Management Programs for Electrical Components Evaluated in Chapter VI of NUREG–1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for 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 CRs 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 WF3 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	Not Applicable to WF3	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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3 (see SER Section 3.6.2.2.2)

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
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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3 (see SER Section 3.6.2.2.3)
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 to WF3	Not Applicable to WF3 (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 to WF3	Not Applicable to WF3 (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	Non-EQ Insulated Cables and Connections	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
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	Non-EQ Sensitive Instrumentation Circuits Test Review	Consistent with the GALL Report
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	Non-EQ Inaccessible Power Cables (≥ 400 V)	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 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
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 Inspection	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 Inspection	Consistent with the GALL Report
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	Metal Enclosed Bus Inspection	Consistent with the GALL Report
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 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
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 to WF3	Not Applicable to WF3
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 to WF3	Not Applicable to WF3
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	Non-EQ Electrical Cable Connections	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
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	Boric Acid Corrosion	Consistent with the GALL Report
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 to WF3	Not Applicable to WF3 (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:

- Boric Acid Corrosion
- Metal Enclosed Bus Inspection
- Non-EQ Electrical Cable Connections
- Non-EQ Inaccessible Power Cables (≥ 400 V)
- Non-EQ Insulated Cables and Connections
- Non-EQ Sensitive Instrumentation Circuits Test Reviews

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, items 3.6.1-2 through 3.6.1-7, 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 WF3. The staff reviewed the LRA and FSAR 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 3.6.1, 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 loss of material due to mechanical wear and reduced insulation resistance in high-voltage insulators composed of porcelain, malleable iron, aluminum, galvanized steel, and cement exposed to air outdoor, respectively. The criteria in SRP-LR Section 3.6.2.2.2 states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging

effects are adequately managed. The acceptance criteria for this further evaluation are described in BTP RLSB-1 (SRP-LR Appendix A.1).

For the high-voltage insulator component listed in Table 3.6.2-1 that corresponds to LRA Table 3.6.1, item 3.6.1-2, the applicant stated that the loss of material due to mechanical wear caused by wind and movement of the associated transmission conductor is not a credible aging effect at WF3 and a plant-specific AMP is not required for this aging effect. The applicant 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 applicant further stated that wear has not been apparent during routine inspections. LRA Table 3.6.2 concludes that the aging effect in the GALL Report for this component, material, and environmental combination is not applicable.

For the high-voltage insulator component listed in Table 3.6.2-1 that corresponds to Table 3.6.1, item 3.6.1-3, the applicant stated that this item is not applicable. The applicant explained that various airborne materials such as salt, dust, and industrial effluent can contaminate high-voltage insulator surfaces, but that the buildup of surface contaminates is a slow process and in most areas removed by rain. The applicant also pointed out that the glazed surface of the insulator assists in the removal of dust, salt, and industrial effluent contamination. The LRA also states that a large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. WF3 is located near the seacoast and other sources of airborne particulates. Surface contamination as identified in the LRA can be a problem in areas where there are greater concentrations of particulates such as near facilities that discharge soot or are near the seacoast where salt spray is prevalent. However, the applicant determined that for WF3, salt spray contamination is a short-term event-driven concern based on local weather conditions. Insulator flashover caused by salt contamination is also stated to be event-driven and not associated with insulator age. The applicant concluded that surface contamination is not an aging mechanism applicable to high-voltage insulators at WF3.

Although not considered an aging mechanism, the applicant stated that periodic visual inspections are performed during system walkdowns of the in-scope high-voltage insulators. The applicant therefore also concluded that reduced insulation resistance because of surface contamination is not an applicable aging effect for high-voltage insulators at WF3 and a plant-specific AMP is not required. LRA Table 3.6.2-1 indicates that the aging effect in the GALL Report for this component, material, and environmental combination is not applicable.

During reviews of LRA Table 3.6.1, items 3.6.1-2 and 3.6.1-3, as compared to the corresponding items in Table 3.6.2-1, the staff noted a discrepancy. Under material listed for these items, Table 3.6.2-1 does not mention malleable iron and aluminum, whereas Table 3.6.1 includes malleable iron and aluminum, which is consistent with the GALL Report for these items. In a letter dated November 7, 2016, the staff issued RAI 3.6.2.2.2-1 requesting that the applicant clarify the discrepancy between Tables 3.6.1 and 3.6.2-1 regarding high-voltage insulator material.

In its response dated December 7, 2016, the applicant stated that aluminum was not a material identified as used in high-voltage insulators at WF3. The applicant noted that malleable iron is implicitly included in LRA Table 3.6.2-1, because it lists galvanized metal that includes malleable iron, ductile iron, and drop-forged steel. With the applicant's clarification that aluminum is not used and that malleable iron is implicitly included in the term galvanized metal, the staff concludes that the applicant's evaluation is consistent with SRP-LR Section 3.6.2.2.2

criteria for components associated with Table 3.6.1, items 3.6.1-2 and 3.6.1-3. The staff also noted that according to EPRI 1013475, “Plant Support Engineering: License Renewal Handbook,” the term galvanized metal is defined to include malleable iron as well as ductile iron and dropped forge steel. The staff’s concern described in RAI 3.6.2.2.2-1 is resolved.

For the high-voltage insulator component listed in LRA Table 3.6.2-1 that corresponds to LRA Table 3.6.1, item 3.6.1-2, the applicant stated that for in-scope high-voltage insulators, mechanical wear and reduced insulation resistance and loss of material due to wind and movement of the associated transmission conductors are not applicable and no AMP is proposed. The applicant’s evaluation concluded that a plant-specific AMP is not required because mechanical wear due to wind for high-voltage insulators is not an applicable aging effect for WF3.

The staff noted that EPRI 1003057, “Plant Support Engineering License Renewal Handbook,” states that mechanical wear in insulators 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 1003057 indicates 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 WF3.

For the high-voltage insulator component listed in Table 3.6.2-1 that corresponds to LRA Table 3.6.1, item 3.6.1-3, the applicant’s evaluation concluded that for high-voltage insulators exposed to salt, dust, or other industrial particulates, surface contamination is not an applicable aging effect for WF3. The applicant cites periodic visual inspections performed at WF3 for monitoring contamination buildup.

Surface contamination of the high-voltage insulator surface increases the possibility of insulator flashover and transmission line outage. The staff finds that insulator flashover is generally caused by contamination buildup over time with a subsequent wetting mechanism due to local weather events (e.g., fog or rain) that allows leakage current to flow in the contaminated surface that may cause flashover of the insulator. The staff noted that EPRI 1003057, “Plant Support Engineering License Renewal Handbook,” states that for high-voltage insulators, rainfall will wash away the gradual buildup of surface contamination and that the glazed insulator surface also aids contamination removal. The staff also noted that EPRI 1003057, in its assessment of high-voltage insulators, found that for plants with moderate rainfall and where airborne contamination is comparatively low, the rate of contamination on the insulator is insignificant. Because WF3 is located near the seacoast and other sources of airborne particulates (e.g., industrial effluent), the rate of contamination may be greater than that discussed in the EPRI report. The periodic system walkdowns performed by the applicant to visually inspect in-scope switchyard high-voltage insulators addresses this concern.

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, demonstrating that a loss of material and reduced insulation resistance aging effects due to mechanical wear, salt deposits, or surface contamination of high-voltage insulators is not an applicable aging mechanism requiring management for WF3.

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 3.6.1, 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 transmission conductors and connections and in switchyard buses and connections. The criteria in SRP-LR Section 3.6.2.2.3 states that the GALL Report recommends 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).

<u>Transmission Conductors Composed of Aluminum, Steel Exposed to Air Outdoor</u>. 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 an air-outdoor environment. LRA Section 3.6.2.2.3 states that loss of conductor strength is not an AERM for WF3 transmission conductors based on WF3 design, and plant-specific and industry 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 WF3 transmission conductor design is bounded by the Ontario Hydro study. The applicant also stated that WF3 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.

In its review of components associated with LRA Table 3.6.1, item 3.6.1-4, the staff noted a discrepancy between LRA Table 3.6.1 and the corresponding items of LRA Table 3.6.2 in describing the materials for transmission conductors. Table 3.6.2 contradicts Table 3.6.1 in that Table 3.6.2 omits steel from the list of transmission conductor materials. LRA Table 3.6.1 is consistent with the SRP-LR Table 3.6.1, with both LRA Table 3.6.1 and SRP-LR Table 3.6.1 including steel in material descriptions. In a letter dated November 7, 2016, the staff issued RAI 3.6.2.2.3-1 requesting that the applicant clarify the discrepancy between LRA Tables 3.6.1 and 3.6.2 regarding transmission conductor material.

In its response dated December 7, 2016, the applicant stated that LRA Table 3.6.2, “Electrical Components,” will be revised to include “steel” for transmission conductors. With the applicant revising Table 3.6.2 to include the material component “steel,” the staff concludes that the applicant’s evaluation is consistent with SRP-LR Section 3.6.2.2.3 criteria for components associated with Table 3.6.1, item 3.6.1-4. The staff’s concern described in RAI 3.6.2.2.3-1 is resolved.

The staff noted that WF3 ACSR transmission conductors of the in-scope switchyard components are susceptible to loss of strength due to corrosion. However, WF3 transmission conductors are bounded by the Ontario Hydro study and will have adequate strength for the

period of extended operation. Therefore, the staff finds that loss of conductor strength due to corrosion of ACSR transmission conductors is not an aging effect at WF3 requiring an AMP.

Transmission Connectors Composed of Aluminum and Steel Exposed to an Air Outdoor Environment. 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 an air-outdoor environment. LRA Section 3.6.2.2.3 states that oxidation and loss of preload are not applicable aging effects for WF3 transmission connectors based on WF3 design and operating experience.

Transmission connectors can be susceptible to increased resistance because of corrosion. Minor corrosion can be expected due to exposure to precipitation that does not affect the ability of the connections to perform intended functions. At WF3, transmission connector surfaces are coated with antioxidant compound (no-ox grease), providing a corrosion-resistant low electrical resistance connection. WF3 transmission connectors are designed and installed using industry standard Belleville washers to preclude torque relaxation. The design of these connections along with operating experience at WF3 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 WF3 transmission connectors have not exhibited significant aging effects based on site-specific experience and the result of routine infrared inspections. In addition, the transmission connectors employ corrosion inhibitors and bolting practices using washers that prevent loss of preload and corrosion of the contact surfaces.

Switchyard Bus Connections Composed of Aluminum, Copper, Bronze, Stainless Steel, Galvanized Steel Exposed to Air Outdoor. 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 an air-outdoor environment. LRA Section 3.6.2.2.3 states that loss of material and increased resistance of connection are not applicable aging effects for WF3 switchyard bus and connections.

Switchyard bus connections can be susceptible to increased resistance because of oxidation. At WF3, switchyard connection surfaces are coated with an antioxidant compound (no-ox grease), providing a corrosion-resistant low electrical resistance connection. The absence of plant-specific operating experience problems with switchyard buses, as evidenced by routine infrared inspection, indicates that increased connection resistance due to general corrosion and oxidation is not an AERM at WF3.

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 Belleville washers to preclude connection degradation because of loss of preload. The operating experience at WF3 has confirmed the absence of loss of preload. Therefore, increased connection resistance due to loss of preload of switchyard connections and switchyard bus connections is not an AERM at WF3. The applicant also stated that loss of material due to wind-induced abrasion and fatigue has not been experienced at WF3 and has not been observed in the review of industry operating experience.

In its review of components associated with LRA Table 3.6.1, item 3.6.1-6, the staff noted a discrepancy between LRA Table 3.6.1 and the corresponding items of LRA Table 3.6.2 in describing the materials for switchyard bus and connections. Table 3.6.2 contradicts Table 3.6.1 in that Table 3.6.2 omits copper, bronze, and galvanized steel from the listing of switchyard bus and connection materials. LRA Table 3.6.1 is consistent with the SRP-LR Table 3.6.1 with both Table 3.6.1 and SRP-LR Table 3.6.1 material descriptions tables, including copper, bronze, and galvanized steel in material description. In a letter dated November 7, 2016, the staff issued RAI 3.6.2.2.3-1 requesting that the applicant clarify the discrepancy between Tables 3.6.1 and 3.6.2 regarding switchyard bus and connection materials.

In its response dated December 7, 2016, the applicant stated that based on WF3 electrical screening and AMR, the switchyard bus and connections are made of aluminum and stainless steel. Copper, bronze, and galvanized steel are not used in WF3 switchyard bus and connections. With the applicant citing the lack of copper, bronze, and galvanized steel at WF3, the staff concludes that the applicant's evaluation is consistent with SRP-LR Section 3.6.2.2.3 criteria for components associated with Table 3.6.1, item 3.6.1-6. The staff's concern described in RAI 3.6.2.2.3-1 is resolved.

The staff reviewed the associated items in the LRA and confirmed that these aging effects are not applicable for this component, material, and environment combination. The staff finds the applicant's evaluation acceptable because wind-borne particulates have not been shown to be a contributor to loss of material at WF3. Operating experience and annual inspections have also demonstrated that increased connection resistance due to corrosion, oxidation, or loss of preload is not an AERM at WF3. 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.

<u>Transmission Conductors Composed of Aluminum, Steel Exposed to Air Outdoor</u>. 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 an air outdoor environment. LRA Section 3.6.2.2.3 states that loss of material is not an applicable aging effect for WF3 transmission conductors.

In its review of components associated with LRA Table 3.6.1, item 3.6.1-7, the staff noted a discrepancy between LRA Table 3.6.1 and the corresponding items of LRA Table 3.6.2 in describing the materials for transmission conductors. Table 3.6.2 contradicts Table 3.6.1 in that Table 3.6.2 omits steel from the list of transmission conductor materials. LRA Table 3.6.1 is consistent with the SRP-LR Table 3.6.1, with both LRA Table 3.6.1 and SRP-LR Table 3.6.1 including steel in material descriptions. In a letter dated November 7, 2016, the staff issued RAI 3.6.2.2.3-1 requesting that the applicant clarify the discrepancy between Tables 3.6.1 and 3.6.2 regarding transmission conductor material.

In its response dated December 7, 2016, the applicant stated that LRA Table 3.6.2, "Electrical Components," will be revised to include "steel" for transmission conductors. With the applicant revising Table 3.6.2 to include the material component "steel," the staff concludes that the applicant's evaluation is consistent with SRP-LR Section 3.6.2.2.3 criteria for components associated with Table 3.6.1, item 3.6.1-7. The staff's concern described in RAI 3.6.2.2.3-1 is resolved.

The applicant reviewed plant-specific and industry operating experience concerning loss of material (wear) due to wind-induced abrasion and concluded that they are not applicable AERMs. The staff noted that wind-borne particulates have not been shown to be a contributor to loss of material at WF3. 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 WF3.

Based on 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 and I&C Components – 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 and I&C components component groups.

Porcelain, Galvanized Metal, Cement High-Voltage Insulators (High-Voltage Insulators for SBO Recovery) Exposed to Air-Outdoor. In LRA Table 3.6.2-1, the applicant stated that high-voltage insulators composed of porcelain, galvanized metal, and cement exposed to an air-outdoor environment, loss of material/mechanical wear due to wind, or reduced insulation resistance due to salt deposits/surface contamination aging effects and mechanisms are not applicable and that no AMP is proposed. The AMR items cite generic note I, which states that the aging effect in the GALL Report for this component, material, and environment combination is not applicable.

The staff reviewed the associated items in the LRA to confirm that these aging effects are not applicable for this component, material, and environment combination. The staff finds the applicant's proposal acceptable based on its further evaluation performed consistent with the SRP-LR Section 3.6.2.2.2 criterion. The staff's evaluation of the applicant's proposal is documented in SER Section 3.6.2.2.2.

Transmission Connectors Composed of Aluminum, Steel and Steel Alloy, and Switchyard Bus and Connections Composed of Aluminum, Steel and Steel Alloy, and Transmission Conductors Composed of Aluminum, for SBO Recovery Exposed to Air-Outdoor. In LRA Table 3.6.2-1, the applicant stated that transmission connectors composed of aluminum and steel exposed to an air-outdoor environment (Table 1, item 3.6.1-5); switchyard bus and connectors composed of copper, bronze, stainless steel, and galvanized steel exposed to an air-outdoor environment (Table 1, item 3.6.1-6); and transmission conductors composed of aluminum and steel exposed to an air-outdoor environment (Table 1, item 3.6.1-7) are not applicable and that no AMP is proposed. The AMR items cite generic note I, which states the aging effect in the GALL Report for this component, material, and environment combination is not applicable.

The staff reviewed the associated items in the LRA to confirm that these aging effects are not applicable for these component, material, and environment combinations. The staff finds the applicant's proposal acceptable based on the applicant's further evaluation performed consistent with the SRP-LR Section 3.6.2.2.3 criterion. The staff's evaluation of the applicant's claim is documented in SER Section 3.6.2.2.3.

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." Based on 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 FSAR 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 and Exemptions in the LRA

This section of the safety evaluation report (SER) provides the U.S. Nuclear Regulatory Commission (NRC) staff's (the staff's) evaluation of the applicant's methodology for identifying time-limited aging analyses (TLAAs) in the applicant's license renewal application (LRA) and the applicant's list of TLAAs in the LRA. TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. This SER section also provides the staff's evaluation of the applicant's basis for identifying exemptions that are based on TLAAs and need to be identified and evaluated in accordance with the regulatory requirements in 10 CFR 54.21(c)(2).

Pursuant to the requirements in Section 54.21(c)(1), of Title 10, *Code of Federal Regulations* (10 CFR 54.21(c)(1)), an application for a renewed license must include a list of TLAAs, as defined in 10 CFR 54.3. Regulations at 10 CFR 54.3 state that TLAAs are those licensee calculations and analyses that:

(1) involve systems, structures, and components (SCC) within the scope of license renewal, as delineated in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (e.g., 40 years)

(4) were determined to be relevant by the applicant in making a safety determination

(5) involve conclusions or provide the basis for conclusions related to the capability of the SSC to perform its intended function(s), as described in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

As specified in 10 CFR 54.21(c)(1), the applicant must demonstrate for TLAAs that either:

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the period of extended operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

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 and that are based on TLAAs. For each exemption identified in accordance with 10 CFR 54.21(c)(2), the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

4.1.1.1 Identification of TLAAs

The applicant stated that the list of TLAAs for the LRA was identified using methods that are consistent with those provided in the “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants” (SRP-LR), and 10 CFR Part 54, “Requirements for Renewal of Operating License for Nuclear Power Plants.” The applicant also stated that the following CLB and design basis documentation sources were searched to identify potential TLAAs: (a) final safety analysis report (FSAR), (b) technical specifications (TS) and their bases, (c) Technical Requirements Manual (TRM), (d) facility operating license, (e) fire protection program documents, (f) inservice inspection procedures, (g) relevant NRC SERs, (h) relevant Westinghouse Commercial Atomic Power (WCAP) reports, and (i) docketed licensing correspondence.

The applicant also stated that a list of potential TLAAs was assembled from the following sources: (a) National Energy Institute (NEI) Report No. 95-10, Revision 6, “Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule,“ June 2005; (b) NUREG-1800, Revision 2, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Revision 2” (SRP-LR), December 2010; and (c) Electric Power Research Institute (EPRI) Technical Report (TR) No. TR-105090, “Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and Time-Limited Aging Analyses,” November 1995.

4.1.1.1.1 Analyses That Are Applicable to the CLB and Conform to the Definition of a TLAA in 10 CFR 54.3(a)

LRA Table 4.1-1 lists the TLAAs that are applicable to CLB for Waterford Unit 3 (WF3). In this table, the applicant identified the following generic analyses as TLAAs for the facility:

- LRA Section 4.2 – Reactor Vessel Neutron Embrittlement
  - LRA Section 4.2.1, Neutron Fluence Projections
  - LRA Section 4.2.2, Upper Shelf Energy
  - LRA Section 4.2.3, Pressurized Thermal Shock
  - LRA Section 4.2.4, Pressure-Temperature Limits
  - LRA Section 4.2.5, Low-Temperature Overpressure Protection Setpoints
- LRA Section 4.3 – Metal Fatigue
  - LRA Section 4.3.1, Class 1 Fatigue
  - LRA Section 4.3.2, Non-Class 1 Mechanical Systems
  - LRA Section 4.3.3, Effects of Reactor Water Environment on Component Fatigue Life
- LRA Section 4.4 – Environmental Qualification (EQ) of Electric Equipment
- LRA Section 4.6 – Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

- LRA Section 4.7 – Other Plant-Specific TLAAs
  - LRA Section 4.7.1, Crane Load Cycle Analysis
  - LRA Section 4.7.2, Leak-Before-Break Analysis
  - LRA Section 4.7.3, Postulation of High Energy Line Break (HELB) Analysis
  - LRA Section 4.7.4, Reactor Vessel Internals Evaluations (Other than Fatigue)

For these TLAAs, the applicant stated that the TLAAs are discussed and evaluated in the applicable LRA sections. The applicant also stated that the evaluations of the TLAAs provide the bases for demonstrating that the TLAAs satisfy either 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.1.1.1.2 Generic TLAAs That Are Not Applicable to the CLB or Analyses That Do Not Conform to the Definition of a TLAA in 10 CFR 54.3(a) (Non-TLAA Analyses)

In LRA Table 4.1-1, the applicant stated that the following types of analyses are not TLAAs because the analyses either are not contained or referenced in the CLB or do not conform to the definition of a TLAA in 10 CFR 54.3(a):

- Concrete Containment Tendon Prestress Analysis
- Inservice Local Metal Containment Corrosion Analyses
- Intergranular Separations in the Heat-Affected Zone of Reactor Vessel Low-Alloy Steel Under Austenitic Stainless Steel (SS) Cladding
- Fatigue Analysis of the Reactor Coolant Pump Flywheel
- Flow-Induced Vibration Endurance Limit for the Reactor Vessel Internals
- Fatigue Analysis for the Containment Vessel or Applicable Containment Liner Plates
- Metal Corrosion Allowance
- Inservice Flaw Growth Analyses That Demonstrate Structural Stability for 40 Years

4.1.1.2 Identification of Exemptions

The applicant stated that it reviewed the following types of documents to search for exemptions 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): (a) FSAR, (b) facility operating license, (c) TS, (d) NRC SERs, (e) American Society of Mechanical Engineers (ASME) Code Section XI program documentation, (f) fire protection program documents, (g) NRC Agencywide Documents Access and Management System (ADAMS) database, and (h) docketed correspondence. The applicant stated that there are no regulatory exemptions 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 NRC's guidance for reviewing LRA Section 4.1 is provided in Section 4.1, "Identification of Time Limited Aging Analyses," in NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR). SRP-LR Section 4.1.1

describes the areas of review and Section 4.1.2 provides the acceptance criteria for performing TLAA and TLAA-based exemption identification reviews.

SRP-LR Section 4.1.3 provides the procedures for reviewing the applicant's identification of TLAAs and TLAA-based exemptions. SRP-LR Table 4.1-2 provides a generic list of analyses or calculations that are typically part of an applicant's CLB and are typically identified as TLAAs in an LRA. SRP-LR Table 4.1-3 provides a list of analyses or calculations that may be identified as plant-specific TLAAs in an LRA.

The staff reviewed the applicant's methodology and TLAA results using the guidance and tables in SRP-LR Section 4.1, as described above. The staff found that the applicant's methodology for identifying TLAAs is consistent with the acceptance criteria in SRP-LR Section 4.1.2, with the exception of the following information in the LRA that needed additional clarification. The staff observed that, in the applicant's methodology for identifying TLAAs, the applicant stated that it had reviewed the list of WCAP technical or topical reports (TRs) that are contained in or referenced in the CLB for WF3. However, the staff noted that the WF3 facility was designed by the ABB Combustion Engineering Company (ABB-CE). Thus, the staff noted that ABB-CE TRs or other types of non-WCAP TRs used in the CLB could also be a source of potential TLAAs for the LRA.

During the aging management program audit conducted July 25–29, 2016, the staff discussed this matter with the applicant. As described in the audit report (ADAMS Accession No. ML17054C529), the applicant stated that the statement in LRA Section 4.1 was intended to mean that the applicant had reviewed all applicable TRs that apply to the CLB. The applicant stated that it also reviewed TRs issued by non-Westinghouse Electric Company organizations, including but not limited to TRs issued by the Combustion Engineering Company (CE) or its owners group, or other applicable vendors, such as Chicago Bridge and Iron (CB&I) Company or Structural Integrity Associates (SIA), Inc.

Therefore, to verify the validity of the applicant's statement, the staff reviewed a number of plant analyses from sources other than the Westinghouse Electric Company or Westinghouse Owners Group (WOG). This included, but was not limited to, the staff's review of the following documents: (a) stress analysis for the steel containment vessel issued by the CB&I, (b) structural integrity analysis (including fatigue flaw growth analysis) for the reactor coolant pump (RCP) flywheels issued by SIA, and (c) analyses in component repair documents for repaired ASME Code Class 1 nickel alloy components, as issued by SIA or other vendors. From this limited review, the staff identified no additional evaluation, analysis, or calculation that would meet the definition of a TLAA. Thus, the staff concluded that the applicant's methodology appropriately included a search of all TRs that are applicable to the CLB, including TRs issued by organizations other than the Westinghouse Electric Company or WOG.

Based on its review, the staff finds that the applicant's methodology for reviewing sources of TLAAs is acceptable because it is consistent with the SRP-LR Section 4.1. The staff's aging management program audit activities related to TLAA identification are documented in the audit report (ADAMS Accession No. ML17054C529).

4.1.2.1.1 Evaluations, Analyses, Calculations, or Assessments That Conform to the Definition of a TLAA, As Defined in 10 CFR 54.3

For the TLAAs listed in LRA Table 4.1-1 and SER Section 4.1.1.1.1, the staff determined that the applicant's identification of these TLAAs is consistent with the generic TLAAs listed in

SRP-LR Table 4.1-2 or potential plant-specific TLAAs listed in SRP-LR Table 4.1-3. Based on its review, the staff finds that the applicant's identification of these TLAAs is acceptable in accordance with 10 CFR 54.21(c)(1). The staff's evaluations of these TLAAs are documented in the applicable subsections of SER Sections 4.2, 4.3, 4.4, 4.6, and 4.7.

4.1.2.1.2 Evaluation of Applicant's List of Evaluations, Analyses, and Calculations That Do Not Conform to the Definition of a TLAA, As Defined in 10 CFR 54.3 (Absence of TLAA Bases)

In LRA Table 4.1-2, the applicant identified that certain analyses listed in SRP-LR Tables 4.1-2 or 4.1-3 are not TLAAs because the analyses either do not conform to the definition of a TLAA in 10 CFR 54.3(a) or are not incorporated into the CLB for WF3.

The staff evaluates the applicant's bases for omitting these types of TLAAs from the LRA in the following subsections.

Inservice Local Metal Containment Corrosion Analyses. SRP-LR Table 4.1-2 indicates that the CLBs may include plant-specific inservice local metal containment corrosion analyses. The SRP-LR also states that these analyses may conform to the definition of a TLAA in 10 CFR 54.3(a) and may need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Table 4.1-2, the applicant stated that the CLB does not include any inservice local metal containment corrosion analyses that would need to be identified as TLAAs in the LRA.

The staff reviewed FSAR Section 6.2, "Containment Systems," to evaluate the validity of the applicant's basis for its conclusion. The staff noted that FSAR Section 6.2 does not include any corrosion analysis for the steel containment vessel. As such, the staff concludes that the LRA does not include an inservice local metal containment corrosion TLAA because the staff has confirmed that the CLB for the facility does not include this type of analysis.

Intergranular Separations in the Heat-Affected Zone of Reactor Vessel Low-Alloy Steel Under Austenitic Stainless Steel (SS) Cladding. SRP-LR Section 3.1.2.2.5 states that SA-508, Class 2 forging components in reactor vessels may be susceptible to cracking in the welds that join the reactor vessel cladding to the reactor vessel forging components. SRP-LR Table 4.1-3 states that the CLB may include plant-specific reactor vessel underclad cracking analyses that may conform to the definition of a TLAA in 10 CFR 54.3(a) and may need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Section 3.1.2.2.5 and LRA Table 4.1-2, the applicant stated that the phenomenon of reactor vessel underclad cracking is not applicable to the design of the WF3 reactor vessel because the structural welds in the reactor vessel were deposited using a low heat input welding method. Therefore, the applicant stated that the CLB does not include any analysis on reactor vessel underclad cracking that would need to be identified as a TLAA in accordance with 10 CFR 54.21(c)(1).

The staff evaluated the applicant's basis for claiming that the CLB does not include any reactor vessel underclad cracking TLAAs in SER Section 3.1.2.2.5. As stated in SER Section 3.1.2.2.5, the staff evaluated the applicant's claim and found it to be acceptable because the staff has confirmed that the applicant has not addressed this issue through the performance of any time-dependent analysis qualifying as a TLAA.

Fatigue Analysis of the Reactor Coolant Pump Flywheel. SRP-LR Table 4.1-3 states that the CLB may include a plant-specific cycle-dependent fatigue or flaw tolerance analysis for RCP flywheels that qualifies as a TLAA for the applicant's LRA. In LRA Table 4.1-1, the applicant stated that the CLB does not include any fatigue or cyclical loading analysis for the RCP flywheels that qualifies as a TLAA.

As described in the aging management program audit report (ADAMS Accession No. ML17054C529), the staff noted that the applicant relies on a 1995 SIA report as the basis for inspecting and evaluating the RCP flywheels. The staff confirmed that the general applicability of the SIA report was approved for CE-designed reactors in a safety evaluation (SE) dated May 21, 1997, and that the specific applicability of the report to WF3 was approved in an SE dated September 22, 2003 (ADAMS Accession No. ML032661240).

The staff noted that the SIA report includes a cycle-dependent flaw growth analysis of the RCP flywheel design at WF3. The staff also noted that the flaw growth analysis assumed a number of RCP start-stop cycles that were more than two times the number of start-stop cycles assumed in the 40-year design basis (i.e., assessed cycles through 80 years of postulated serviceable operations). Thus, the staff confirmed that the time-dependency of the flaw growth analysis in the SIA report extends beyond the end of the period of extended operation for WF3. Therefore, based on its review, the staff concludes that the flaw growth analysis in the SIA report does not meet the definition of a TLAA because it does not involve a time-dependent assumption defined by the current operating period and thus does not conform to Criterion 3 in 10 CFR 54.3(a).

Flow-Induced Vibration Endurance Limit for the Reactor Vessel Internals. SRP-LR Table 4.1-3 indicates that the CLB may include flow-induced vibration analyses for RVI components. The SRP-LR states that these analyses may conform to the definition of a TLAA in 10 CFR 54.3(a) and may need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Table 4.1-2, the applicant stated that the CLB for WF3 does not include any RVI flow-induced vibration analyses that conform to the definition of a TLAA in 10 CFR 54.3(a) or would need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

The applicant indicated that its basis for managing flow-induced vibrations of RVI components is described in FSAR Section 3.9.2.4 as follows. FSAR Section 3.9.2.4 identifies that the assessment of flow-induced vibrations in the WF3 RVI components is based on conformance with the staff's criteria and regulatory position in Regulatory Guide (RG) 1.20, Revision 1, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing" (June 1975). For a non-prototype, Category 1 plant such as WF3, this RG allows the applicant to use the RVI flow-induced vibration assessments from other plants as long as the plant has implemented a vibration analysis program and either a vibration measurement program or an inspection program. The vibration analysis program is a potential source of a TLAA.

The staff confirmed that the RVI components at WF3 were categorized as Category I, non-prototype components and that the applicant had been approved to use the following prototypical reports as the basis for assessing RVI flow-induced vibrations at WF3:

- Combustion Engineering Report No. CENPD-55, "Analysis of Flow-Induced Vibrations: Maine Yankee Precritical Vibration Monitoring Program Predictions," May 30, 1972

- Combustion Engineering Report No. CENPD-93, “Maine Yankee Precritical Vibration Monitoring Program, Final Report,” February 1973
- Combustion Engineering Report No. CENPD-85, “Analysis of Flow-Induced Vibrations: Fort Calhoun Precritical Vibration Monitoring Program,” January 1973
- Combustion Engineering Report No. CEN-8, Revision 0, “Omaha Precritical Vibration Monitoring Program, Final Report,” May 1974

Based on past experience, including responses to requests for additional information (RAIs) issued during previous LRA reviews, the staff noted that the analysis of flow-induced vibrations in these types of prototypical reports does not conform to the definition of a TLAA because the stress-intensity levels associated with the vibrations are below the threshold for inducing fatigue in the components (i.e., the stress-intensity levels are below the stress values associated with the fatigue endurance limits). This demonstrates that the analysis of flow-induced vibrations does not involve any time-dependent assumptions defined by the current operating term. Therefore, the staff concludes that the analysis of flow-induced vibrations in these reports is not associated with any TLAA because the analyses are not based on any time-dependent assumptions and therefore are not a TLAA.

<u>Fatigue Analysis for the Containment Vessel or Applicable Containment Liner Plates</u>. SRP-LR Section 4.6 states that the CLB may include fatigue analyses for the containment vessel. The SRP-LR states that these types of analyses may need to be identified as TLAAs when assessed against the six criteria for defining TLAAs in 10 CFR 54.3(a). SRP-LR Section 4.6 provides the staff’s recommended plant-specific review procedures for reviewing these types of TLAAs in accordance with the TLAA acceptance criteria in 10 CFR 54.21(c)(1)(i), (ii), or (iii).

In LRA Table 4.1-2 and LRA Section 4.6, the applicant stated that the CLB does not include any fatigue analysis for the steel containment vessel at WF3 or any applicable containment liner plates. The analyses for the liner plates would only apply if the containment were designed as a concrete structure with an interior steel liner. The applicant specifically stated that it only performed elastic stress analyses of the containment vessel and that the CLB did not include any structural fatigue or cyclical loading analyses for the containment vessel. The staff evaluated the applicant’s statement against the information in the FSAR to confirm the validity of the applicant’s basis for this TLAA identification topic.

The staff noted that FSAR Section 3.8 states that the containment vessel is made from steel vertical cylinders, hemispherical domes, and flat circular bases. The FSAR also states that the steel containment vessel was designed in accordance with the requirements in Article NE-3000 of the 1971 Edition of ASME Code Section III. The applicant further stated that it did not perform or will not be performing a structural fatigue analysis for the containment vessel.

The staff noted that potential fatigue analyses for containment liners would not apply to the plant design at WF3 because the containment is designed as a steel containment vessel. However, the staff determined that additional clarification would be needed because TLAAs could potentially exist for the design of the steel containment vessel at WF3. Specifically, the staff noted that the design rules in the 1971 Edition of ASME Code Section III, Article NE-3000, paragraph NE-3322 would require the applicant to either perform a fatigue waiver analysis in accordance with requirements in paragraph NB-3222.4(d) of the Code, or else to perform a cyclical loading analysis in accordance with NB-3222.4(e) for the portions of the containment structure that could not comply with the fatigue waiver acceptance criteria in paragraph NB-3222.4(d).

During the performance of the second AMP audit (ADAMS Accession No. ML17054C529), the staff confirmed that the CLB for WF3 includes a fatigue waiver analysis for the steel containment vessel. The staff also confirmed that the fatigue waiver analysis was included in the stress analysis for the containment vessel, which was performed by CB&I as part of its efforts to satisfy the design requirements for initial plant licensing (citation). Based on the audit review, the staff confirmed that the fatigue waiver analysis did not include any time-dependent assumptions defined by the current operating term. Therefore, based on its review, the staff concludes that the applicant has provided an adequate basis for concluding that the fatigue waiver analysis is not a TLAA because the staff has confirmed that it does not involve a time-dependent assumption defined by the current operating term and does not conform to Criterion 3 in 10 CFR 54.3(a).

Metal Corrosion Allowance. SRP-LR Table 4.1-3 indicates that some plant CLBs may include metal corrosion analyses for metallic components in the plant designs. The SRP-LR also states that these analyses may conform to the definition of a TLAA in 10 CFR 54.3(a) and may need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Table 4.1-1, the applicant stated that the CLB does not include any component-specific metal corrosion allowance analyses that conform to the definition of a TLAA in 10 CFR 54.3(a) or would need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1).

The staff reviewed the FSAR for relevant information. The staff noted that FSAR Section 5.4.2.3.1.1 states that the wall thicknesses of some of the steam generator (SG) tubes were designed with a metal corrosion allowance (i.e., an additional amount of metal that was included in the design for tube wall thickness). However, the staff noted that the FSAR did not specify that the metal corrosion allowance was based on any analysis involving time-dependent assumptions defined by the current operation term. As such, the staff did not identify any metallic plant components that were designed with corrosion allowances, in which the amount of additional metal used in the design of the components was based on the results of a TLAA. Therefore, the staff concludes that the CLB does not include any metal corrosion allowance analyses that are based on time-dependent assumptions defined by the current operating period or that would otherwise conform to the definition of a TLAA in 10 CFR 54.3(a).

Inservice Flaw Analyses That Demonstrate Structural Stability for 40 years. SRP-LR Table 4.1-3 indicates that the CLB may include inservice flaw or fracture mechanics analyses that are used to demonstrate the structural integrity or stability of a given component or structure over a 40-year design life. The SRP-LR also states that these analyses may conform to the definition of a TLAA in 10 CFR 54.3(a) and may need to be identified as TLAAs in accordance with 10 CFR 54.21(c)(1). In LRA Table 4.1-1, the applicant stated that the CLB does not include any inservice flaw or fracture mechanics analyses used to demonstrate the structural integrity or stability of a given component or structure over a 40-year design life.

During the aging management program audit (ADAMS Accession No. ML17054C529), the staff noted that the CLB includes cyclical loading analyses for repaired or mitigated Alloy 600 base metal locations and Alloy 82 or 182 weld component locations in the reactor coolant pressure boundary (RCPB) (as described in the audit report) and these analyses are based on time-dependent assumptions.

The staff confirmed that the assessments of design transient cycles for the applicable flaw growth or fracture mechanics evaluations are based on a 45-year operating period. The staff noted that WF3 was licensed to operate in March 1985 and that these flaw evaluations for these

components would be TLAAs if the overlay modifications were installed between March 1985 and March 2000 (i.e., if the analyses involve the time periods bounded by the period of extended operation). However, the staff confirmed that the applicant implemented these repairs after March 2000.

Because the repairs of these components were implemented after March 2000, the staff determined that the time periods associated with the analyses extend beyond the period of extended operation for WF3 and therefore do not involve time-dependent assumptions defined by the current operating term, as defined in Criterion 3 for defining TLAAs in 10 CFR 54.3(a). Based on its review, the staff concludes that the applicant has provided an adequate basis for concluding that these flaw analyses are not TLAAs because the staff has confirmed that the analyses are not based on time-dependent assumptions defined by the current operating term and do not conform to Criterion 3 for defining TLAAs in 10 CFR 54.3(a).

Other Potential Plant-Specific TLAAs Not Addressed in the LRA. The staff reviewed the information in Section 4.1 of the SRP-LR and in the FSAR for WF3 to determine whether the LRA would need to include any additional TLAAs. Specifically, SRP-LR Table 4.1-3 states that the CLB may include a TLAA associated with a main steam supply line to a PWR steam-driven auxiliary feedwater pump. The staff noted that the safety-related auxiliary feedwater systems at WF3 are defined as emergency feedwater systems. However, the staff reviewed the FSAR and confirmed that the delivery pumps for the emergency feedwater systems are powered by electrical motor operators instead of a steam delivery system. Therefore, the staff confirmed that the potential TLAA referenced in SRP-LR Table 4.1-3 for a main steam supply line to auxiliary feedwater pump is not applicable to the CLB for WF3.

Aging management review (AMR) item IV.C2.R-223 of the GALL Report addresses metal fatigue analyses for PWR RCPB piping components, which include ASME Code Class 1 valve bodies. The staff noted that FSAR Sections 3.9.1.1.2 and 5.4.12 state that metal fatigue analyses (i.e., cyclical loading and design transient analyses) were performed as part of the CLB for large-bore, Class 1 valves included in the plant design. However, the staff noted that the applicant did not include any section in the LRA that identified these analyses as TLAAs or evaluated the analyses against the criteria in 10 CFR 54.21(c)(1)(i), (ii), or (iii).

By letter dated October 12, 2016 (ADAMS Accession No. ML16285A338), the staff issued RAI 4.1-1 to the applicant. In this RAI, the staff asked the applicant to justify its basis for omitting a metal fatigue or cyclical loading TLAA assessment section for large bore, Class 1 valves in the LRA. The staff also asked the applicant to amend the LRA accordingly, if it is determined that the cyclical loading and design transient analyses for these valves are analyses that meet the definition of a TLAA in 10 CFR 54.3(a).

The applicant responded to RAI 4.1-1 in a letter dated November 10, 2016 (ADAMS Accession No. ML16315A235). In its response, the applicant stated that the Class 1 valve fatigue analyses were evaluated as TLAAs. The applicant also stated that the TLAA evaluation results described in LRA Section 4.3.1.7 include the results of the evaluation of Class 1 valve fatigue TLAAs. To further clarify, the applicant amended LRA Section 4.3.1.7 to identify that the metal fatigue analyses for the Class 1 valves are within the scope of the TLAA assessment for the Class 1 piping components in LRA Section 4.3.1.7. In addition, the applicant stated that the applicable FSAR supplement summary description for these TLAAs in LRA Section A.1.2.2 is amended accordingly.

The staff confirmed that the applicant made the appropriate amendments to LRA Section 4.3.1.7 to include the metal fatigue analyses for the Class 1 valves among the scope of the metal fatigue analyses for Class 1 piping and piping components. The staff also confirmed that the applicant amended LRA FSAR supplement Section A.1.2.2 accordingly. Based on the applicant's amendments to LRA Sections 4.3.1.7 and A.1.2.2 to include the metal fatigue analyses for the large bore, Class 1 valves as TLAAs for the LRA, the staff finds that the applicant has met the requirements of 10 CFR 54.21(c)(1) for identifying these analyses as TLAAs for the LRA. The issue in RAI 4.1-1 is resolved. The staff's evolution the metal fatigue analyses for the Class 1 piping, piping components, and valves is documented in SER Section 4.3.1.7.

4.1.2.2 Identification of Exemptions

In LRA Section 4.1.2, the applicant stated that it did not identify any exemptions that were based on a TLAA and were granted in accordance with the NRC's regulatory exemption acceptance criteria in 10 CFR 50.12. The staff performed a search of the NRC's ADAMS database to identify any exemptions that were granted to WF3 in accordance with the requirements in 10 CFR 50.12 and are based on a TLAA. The staff confirmed that the NRC granted the following exemptions in the CLB from complying with 10 CFR Part 50 requirements:

- 10 CFR Part 50, Appendix J, containment leak rate testing requirements
- 10 CFR 50.46 and 10 CFR Part 50, Appendix K, requirements for operating effective emergency core cooling systems
- 10 CFR Part 50, Appendix E, emergency preparedness requirements

The staff noted that these exemptions permit the use of alternative implementation schedules from those in the applicable regulations or those in WF3-proposed alternatives that were not based on time-dependent relationships. Thus, the staff confirmed that the CLB does not include any exemptions granted under the criteria of 10 CFR 50.12 and that are based on a TLAA. Based on its review, staff concludes that the applicant has provided a valid basis for concluding that the CLB does not include any exemptions conforming to the criteria in 10 CFR 54.21(c)(2).

The staff performed a review of the current TS for the WF3 facility. The staff did not identify any new TS or changes to TS requirements that are needed to manage the effects of aging for those structures or components that are within the scope of license renewal and are subject to an AMR. Therefore, based on its assessment, the staff confirmed that the applicant does not need to propose any TS requirement changes in accordance with the requirements of 10 CFR 54.22.

Based on its review, the staff concludes that, pursuant to the requirements in 10 CFR 54.3(a) and 10 CFR 54.21(c)(1), the applicant has adequately identified the analyses in the CLB that conform to the definition of a TLAA in 10 CFR 54.3(a) and are required to be identified as TLAAs in the LRA. The staff also concludes that, with respect to the requirements in 10 CFR 54.21(c)(2), the CLB does not include any regulatory exemptions that were granted by the NRC in accordance with the requirements in 10 CFR 50.12 and that are based on a TLAA. The staff also concludes that, pursuant to the requirement in 10 CFR 54.22, the applicant does not need to propose any new TS requirements or change any existing TS requirements to manage the effects of aging during the period of extended operation.

4.2 <u>Reactor Vessel Neutron Embrittlement</u>

LRA Section 4.2 provides the applicant's analyses of the areas related to neutron embrittlement.

4.2.1 Reactor Vessel Fluence

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 describes the applicant's evaluation of TLAAs on reactor vessel neutron fluence. The technical information provided in LRA Section 4.2.1 is summarized as follows. The neutron fluence values for the reactor vessel have been projected to the end of the period of extended operation (55 effective full-power years (EFPY)). These fluence values are used in neutron embrittlement TLAAs. The fluence calculational methods satisfy the criteria set forth in RG 1.190, "Calculational and Dosimetry Methods for Determining Vessel Neutron Fluence," March 2001. The NRC has approved these methods and they are described in detail in WCAP-14040-A, Revision 4, and WCAP-16083-NP-A, Revision 0. LRA Tables 4.2-1 and 4.2-3 describe reactor vessel beltline components and their 55-EFPY fluence values. The peak reactor vessel wall fluence for 55 EFPY is 4.32×10^{19} n/cm^2 (E > 1 MeV). The applicant dispositioned the TLAA for reactor vessel neutron fluence in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating 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 states that the applicant should identify: (a) the neutron fluence for the reactor vessel at the end of the license renewal period, (b) the staff-approved methodology used to determine the neutron fluence (or should submit the methodology for staff review), and (c) whether the methodology follows the guidance in NRC RG 1.190.

The staff noted the following inconsistency between the LRA and onsite documentation with respect to the references to fluence calculational methods. LRA section 4.2.1 indicates that the applicant's fluence methods are described in detail in WCAP-14040-A, Revision 4, and WCAP-16083-NP-A, Revision 0. LRA Section 4.2.1 also states that the methods used to calculate the WF3 reactor vessel fluence satisfy the criteria set forth in RG 1.190. In contrast, the staff noted that WCAP-18002-NP, Revision 0, describes neutron embrittlement TLAAs and their technical bases for WF3 reactor vessel integrity. Specifically, Section 2 of WCAP-18002-NP, Revision 0, includes the following information:

- WCAP-14040-A, Revision 4, and WCAP-16083-NP-A, Revision 0, describe NRC-approved fluence methods, which include the one-dimensional/two-dimensional (1D/2D) flux synthesis technique to obtain a three-dimensional (3D) neutron flux. These WCAP reports also mention the 3D neutron transport calculation code, TORT.
- The neutron fluence values of the WF3 reactor vessel were calculated using a Westinghouse-developed code, RAPTOR-M3G, which is similar to TORT.

From this review, the staff identified that the applicant needed to clarify whether the fluence method used for the LRA fluence values, the RAPTOR-M3G code, had been incorporated into the CLB through the staff's review and approval. By letter dated October 12, 2016, the staff issued RAI 4.2.1-1 requesting that the applicant clarify whether the RAPTOR-M3G-code method

has been incorporated into the CLB through the staff's review and approval. In its response dated February 6, 2017 (ADAMS Accession No. ML17037D400), the applicant stated that the use of the RAPTOR-M3G code for reactor vessel neutron fluence calculations was incorporated into the WF3 current license basis by Engineering Change (EC) 68581.

As previously discussed, the staff noted that LRA Section 4.2.1 states that the methods used to calculate the reactor vessel fluence satisfy the criteria set forth in RG 1.190. In its review, the staff also noted that RG 1.190, Section 3, describes the following guidance related to reactor vessel fluence calculational methods and reporting of the methods.

- When fluence determinations are required by the regulations, the licensee's documentation describing the determination of pressure vessel fluence must provide a complete description of the methods used to calculate and measure the neutron fluences.
- In applying the methodology of RG 1.190, the details of the application and the results should be reported as described in Section 3 of the RG.
- The reporting guidance in RG 1.190 applies to the following items: (a) fluence methods, (b) multigroup fluences, (c) integral fluences (including uncertainties), (d) comparisons of calculation and measurement, and (e) specific activities and average reaction rates. Table 1 of the RG summarizes the specific regulatory positions on reporting.

The staff noted that the applicant's February 6, 2017, response did not provide relevant information (or references) to address the reporting guidance of RG 1.190. The staff also noted that the applicant's response did not provide a summary of the reference document (i.e., EC 68581) to demonstrate that the use of the RAPTOR-M3G code is adequate for reactor vessel neutron fluence calculations. In addition, the staff found a need for additional information regarding the applicant's fluence calculations for reactor vessel nozzle areas.

By letter dated April 3, 2017, the staff issued RAI 4.2.1-1a requesting that the applicant provide information that demonstrates that the RAPTOR-M3G-code method meets the criteria in RG 1.190, Table 1 and Section 3 (i.e., fluence calculation methods, fluence measurement methods, reporting provisions, and the associated items described in RG 1.190, Table 1). The staff also requested that the applicant describe the technical basis in EC 68581 for use of the RAPTOR-M3G code. In addition, the staff requested that the applicant explain how the RAPTOR-M3G-code method considered the following items that can affect fluence calculations for reactor vessel nozzle areas: (a) axial distribution and isotopic content of uranium-235 and plutonium-239 in the fuel when calculating the fission source, (b) biological shield concrete composition, (c) cavity gap between the reactor vessel and the biological shield, (d) homogenized materials above and below the active core region, and (e) discretization effects on deterministic calculations (e.g., nozzle flux increases have resulted from changing from level symmetric (S_{16}) to quadruple range (QR_{16}) quadrature).

In its response dated May 2, 2017, as supplemented by letters dated November 28, 2017, and December 7, 2017, the applicant provided information to demonstrate that its use of the RAPTOR-M3G code is consistent with RG 1.190. Entergy also submitted a license amendment request (LAR) by letter dated November 28, 2017 to incorporate the RAPTOR-M3G-code method in the WF3 CLB. The staff approved the LAR for the current license term (40 years) as documented in the SE dated July 23, 2018 (ADAMS Accession No. ML18180A298). The applicant's response to RAI 4.2.1-1a regarding the license renewal neutron fluence TLAA is further described and evaluated below.

With respect to the neutron transport calculations, the applicant confirmed that the calculations use the following: (a) plant-specific modeling data for the reactor model (e.g., geometry and material data); (b) BUGLE-96 nuclear data library based on the ENDF/B-VI nuclear data file; (c) P_5 angular decomposition of the scattering cross-sections and S_{16} angular quadrature for angular discretization; and (d) geometric meshes of 160 radial by 121 azimuthal by 247 axial intervals for the reactor model, which are sufficient to ensure proper pointwise convergence in the neutron transport calculations. In its reviews, the staff finds that the fluence calculational method discussed above adheres to RG 1.190 and is consistent with the CLB fluence method (as incorporated by the LAR); therefore, the applicant's response is acceptable.

In its response regarding the axial distribution and isotopic content of uranium-235 and plutonium-239 in the fuel, the applicant indicated that the spectral variations in the neutron source are considered as derived from the detailed fuel assembly burnup distributions for individual fuel cycles. Based on its review, the staff finds the applicant's response acceptable because the applicant clarified that the axial distribution and isotopic content of these nuclides are determined in proper consideration of the core design, fuel burnup, fission reaction, and fuel assembly power distribution.

The applicant also indicated that, in the modeling of the reactor cavity region, a standard, generic concrete composition is used and the potential uncertainty associated with the concrete composition input is accounted for in the "other factors" uncertainty component (5 percent) of the analytical uncertainty analysis. In its review, the staff finds the applicant's response acceptable because the use of the generic concrete composition is reasonably conservative for the modelling of the reactor cavity region and the additional uncertainty component for other factors also accounts for potential concrete composition uncertainty.

The staff also finds that the applicant's response regarding the reactor cavity modelling acceptable because the applicant confirmed that the reactor cavity was designed and built in accordance with the dimensions specified in the plant drawings and those dimensions were used in the cavity modelling for fluence calculations. The staff further finds that the applicant's response regarding the homogenized materials above and below the active core region is acceptable because the applicant clarified that the neutron transport model used an approximate mixture that considers both stainless steel and borated water in the fluence calculations for the regions above and below the active core.

In addition, the applicant indicated that no significant discretization effects are expected between the S_{16} and QR_{16} angular quadrature approximations in the fluence calculations for the extended beltline region because the 60-year extended beltline region of the applicant's reactor vessel is located below the reactor vessel nozzle. Based on its review, the staff finds the applicant's response acceptable because the reactor vessel region below the nozzle is not significantly subject to the potential discretization effects due to the use of different angular quadrature approximations.

With respect to the uncertainty analysis and method qualification, the staff noted that the applicant's approaches for license renewal fluence TLAAs are consistent with those described in the staff-approved LAR for the current license term. Therefore, the staff's evaluation for these items also focused on the adequacy of the fluence method for the extended period of operation and the corresponding extended beltline region as further described below.

In its review, the staff noted that the analytical uncertainty analysis includes the reactor vessel inside radius location at 52-cm elevation above the top of the core, which corresponds to the

upper-to-intermediate shell circumferential weld location. This specific weld location in the extended beltline region is important because this weld has a 55-EFPY adjusted reference temperature that is almost equivalent to that of the limiting material of the reactor vessel (i.e., lower shell plate M-1004-2).

The staff noted that the overall fluence uncertainty at this weld location is 18 percent. In comparison, the reactor vessel inner radius location at the 12-cm elevation relative to the middle of the core has an overall fluence uncertainty of 14 percent. The staff finds that these overall uncertainty values (18 percent and 14 percent) for the extended and original beltline regions account for all significant analytic uncertainty components and are less than the 20-percent uncertainty criterion specified in RG 1.190; therefore, these uncertainty values for the neutron fluence TLAA are acceptable.

The applicant also used the in-vessel and ex-vessel neutron dosimetry (EVND) data from operating reactors to confirm the qualification of the RAPTOR-M3G-code method for the neutron fluence TLAA. Specifically, the EVND data included dosimetry data from off-midplane locations to demonstrate the adequacy of the fluence method for the extended beltline fluence calculations. However, the applicant's response discussed above did not allow for identification of the off-midplane capsules relative to the upper-to-intermediate shell circumferential weld location. Therefore, the staff could not determine whether the off-midplane capsule data actually provide reasonable validation for the area of steep neutron flux gradients above the top of the active fuel.

By letter dated March 26, 2018, the staff issued RAI 4.2.1-2 requesting that the applicant provide information on the axial location for the EVND off-midplane capsules. The staff also requested that the applicant provide summary tables with individual reaction rate measured-to-calculated (M/C) ratios for the subset of EVND capsules that correspond to the region nearest to the upper-to-intermediate shell circumferential weld location to confirm that the measurement benchmark results are consistent with the guidance in RG 1.190.

In its response dated April 23, 2018, the applicant indicated that the off-midplane capsules are located at elevations up to 38.1 cm above the top of the active fuel, including approximately 25, 18, 16, 3, and 0 cm elevations. The staff finds that the locations of these capsules can reasonably represent the extended beltline region that involves steep neutron flux gradients and, therefore, are acceptable to use in the qualification of the fluence method for the extended beltline fluence calculations.

The staff further noted that the average value of the reaction rate M/C ratios for the top capsules (from each plant in the EVND program) is 0.99 with a standard deviation of 17.7 percent. In its review, the staff finds that the calculations using the RAPTOR-M3G code are in agreement with the dosimetry measurement data, consistent with the 20-percent uncertainty criterion in RG 1.190.

Based on the above discussion and evaluation, the staff's concerns described in RAIs 4.2.1-1, 4.2.1-1a, and 4.2.1-2 are resolved. The staff finds that the applicant demonstrated that the fluence method used in the neutron fluence TLAA is consistent with the guidance in RG 1.190.

Based on its review, the staff finds the applicant has demonstrated 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. Additionally, the staff finds that the applicant's reactor vessel neutron fluence analysis meets the acceptance criteria in SRP-LR

Section 4.2 because the applicant has appropriately projected the ID and 1/4T neutron fluence values for the reactor vessel to the end of the period of extended operation (i.e., to 55 EPFY) using a neutron fluence methodology (i.e., RAPTOR) that adheres to the guidance in RG 1.190.

4.2.1.3 FSAR Supplement

LRA Section A.4.2.1, as amended by letter dated April 23, 2018, provides the FSAR supplement summarizing the TLAA on the reactor vessel neutron fluence. The staff reviewed amended LRA Section A.4.2.1, consistent with the review procedures in SRP-LR Section 4.2, which states that the applicant should provide a summary description of the evaluation of the reactor vessel neutron embrittlement. On the basis of its review of the FSAR 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

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 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 FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.2 Upper-Shelf Energy

Paragraph IV.A.1 of 10 CFR Part 50, Appendix G, specifies the requirements for demonstrating that reactor vessels will have adequate fracture toughness throughout their operating periods. The rule requires that reactor vessel beltline components made of ferritic materials must have Charpy upper-shelf energy (USE) equal to or above 75 foot-pounds (ft-lbs) initially and must maintain Charpy USE no less than 50 ft-lbs throughout the operating period of the reactor vessel. In addition, RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” provides guidance for acceptable methods to calculate USE values. When applicants cannot demonstrate compliance with these requirements, they are required to demonstrate that the lower values of USE will provide adequate safety margins against fracture equivalent to those required by Appendix G of the ASME Code Section XI incorporated by reference in 10 CFR 50.55a, “Codes and Standards.”

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 describes the applicant’s TLAA on Charpy USE of reactor vessel beltline materials for the period of extended operation. The technical information in the LRA is summarized as follows.

The 55-EFPY USE values for reactor vessel beltline materials were determined using methods consistent with RG 1.99, Revision 2, and 1/4T fluence values for 55 EFPY as identified in LRA Section 4.2.1. The applicant projected USE values of beltline materials to determine if they remain no less than the USE limit of 50 ft-lbs for the period of extended operation. The limiting USE value for 55 EFPY is 73 ft-lbs. This analysis confirms that the USE values of all beltline materials are projected to remain above the USE limit of 50 ft-lbs through 55 EFPY.

The applicant dispositioned the USE TLAA for the reactor vessel materials in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the period of extended operation.

4.2.2.2 Staff Evaluation

The staff reviewed the USE TLAA and the basis for dispositioning the TLAA in accordance with 10 CFR 54.21(c)(1)(ii), consistent with the acceptance criteria in SRP-LR Section 4.2.2.1.1.2 and the review procedures in SRP-LR Section 4.2.3.1.1.2. SRP-LR Section 4.2.3.1.1.2 states that the review of the revised USE analysis results should be based on the review of the projected 1/4T neutron fluence projections for the reactor vessel beltline components at the end of the period of extended operation, and the impacts that those fluence values will have on the USE values for the beltline components at the end of the period of extended operation. SRP-LR Section 4.2.3.1.1.2 also states that the staff should confirm whether the results of the USE TLAA are in compliance with USE requirements or equivalent margins analysis requirements for reactor vessel beltline components, as defined in 10 CFR Part 50, Appendix G.

RG 1.99, Revision 2, states that Charpy USE of reactor vessel materials decreases as a function of neutron fluence and copper content. RG 1.99, Revision 2, describes two methods for determining USE values for reactor vessel materials, depending on whether two or more credible surveillance data sets become available from the reactor in question. Regulatory Position 1.2 of RG 1.99, Revision 2, uses Figure 2 of the RG when surveillance data sets are not available. When surveillance data are available, Regulatory Position 2.2 of RG 1.99, Revision 2, determines the decreases in USE by plotting the surveillance data on Figure 2 of the RG and fitting the data with a line drawn parallel to the existing lines as the upper bound of all the surveillance data.

The applicant indicated that it used Regulatory Position 1.2 of RG 1.99, Revision 2, to project the USE values to the 60-year period of extended operation (55 EFPY) for the reactor vessel beltline materials that do not have credible surveillance data. The applicant also indicated that, when surveillance data were available to project USE values, it determined the projected USE values in accordance with Regulatory Position 2.2 of RG 1.99, Revision 2. For the materials with credible surveillance data, LRA Table 4.2-2 indicates that the applicant’s projections without using the surveillance data resulted in the lower (more conservative) USE values. The staff also noted that the copper contents and unirradiated USE values of the beltline materials in the LRA are consistent with information in the applicant’s CLB documents (e.g., Table E-1 of WCAP-17969-NP, Revision 0, “Analysis of Capsule 83 from the Entergy Operations, Inc. Waterford Unit 3 Reactor Vessel Radiation Surveillance Program,” April 2015 (ADAMS Accession No. ML15222A361)).

In its review, the staff used the guidance in RG 1.99, Revision 2, to confirm the adequacy of the USE values projected at the end of the period of extended operation. The staff finds that the applicant adequately projected 55-EFPY USE values at 1/4T and that the projected USE values are greater than 50 ft-lbs in compliance with Appendix G to 10 CFR Part 50. Based on the analysis for the beltline materials, the staff specifically confirmed that the applicant’s projected USE values were determined conservatively and the limiting USE value for 55 EFPY is 73 ft-lbs (i.e., USE of upper shell longitudinal welds, Heat No. 606L40).

On the basis of its review, the staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(ii), that the USE analysis for the reactor vessel has been projected to the end of the period of extended operation. Additionally, the staff finds that the applicant’s USE

analysis meets the acceptance criteria in SRP-LR Section 4.2.2.1.1.2 because the applicant's analysis adequately demonstrates that the projected USE values for the reactor vessel beltline materials at the end of the period of extended operation are not less than 50 ft-lbs in compliance with the requirements of 10 CFR Part 50, Appendix G; therefore, the applicant's USE TLAA is acceptable.

4.2.2.3 FSAR Supplement

LRA Section A.2.1.2 provides the final safety analysis report (FSAR) supplement summarizing the USE TLAA for the reactor vessel. The staff reviewed LRA Section A.2.1.2, consistent with the review procedures in SRP-LR Section 4.2.3.2, which states that the applicant should provide a summary description of the evaluation of the reactor vessel neutron embrittlement TLAA and provide information equivalent to SRP-LR Table 4.2-1. Based on its FSAR supplement review, the staff finds that the applicant provided an adequate summary description of its actions to address USE, as required by 10 CFR 54.21(d).

4.2.2.4 Conclusion

On the basis of its review, the staff finds that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), that the USE calculation for the reactor vessel has been projected to the end of the period of extended operation and meets the acceptance criteria of Appendix G to 10 CFR Part 50. The staff also concludes that the FSAR supplement contains an appropriate summary description of the USE TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.3 Pressurized Thermal Shock

The regulation in 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," establishes the requirements for protecting the reactor vessel against the consequences of postulated pressurized thermal shock (PTS) events. The regulation also requires that the reference temperature for PTS (RT_{PTS}) values for the reactor vessel materials be less than or equal to a specific value (screening criterion) at the end of the licensed term of the facility.

In addition, the regulation in 10 CFR 50.61 requires that the RT_{PTS} value for each reactor vessel beltline material must be calculated in accordance with the following equation: $RT_{PTS} = RT_{NDT(U)} + \Delta RT_{NDT} + M$. In this equation, $RT_{NDT(U)}$ is the initial (unirradiated) reference temperature for the material, as derived from the drop weight test and Charpy impact test data in accordance with ASME Code Section III, NB-2331, or a staff-approved alternative method. ΔRT_{NDT} is the shift in the RT_{NDT} value that is induced by neutron irradiation and M is the margin term that is added into the calculation to account for uncertainties as described in 10 CFR 50.61.

4.2.3.1 Summary of Technical Information in the Application

LRA Section 4.2.3 describes the applicant's evaluation of PTS for WF3. The technical information is summarized as follows.

As described in LRA Table 4.2-3, the limiting RT_{PTS} value for base metal and longitudinal welds at 55 EFPY is 57 °F (upper shell plate M-1002-2) and the limiting RT_{PTS} value for circumferential welds at 55 EFPY is 73 °F (upper-to-intermediate shell circumferential weld 106-121, Heat No. 3P4767). These limiting values meet the acceptance criteria of 10 CFR 50.61. The

applicant dispositioned the PTS TLAA in accordance with 10 CFR 54.21(c)(1)(ii) by demonstrating that the analysis has been projected to the end of the period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 to confirm that the PTS analysis has been adequately projected to the end of the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(ii). The staff also reviewed LRA Section 4.2.3, consistent with the review procedures in SRP-LR Section 4.2.3.1.2.2, which indicates that the review should confirm that the PTS analysis is consistent with the requirements, including the analysis methods, in 10 CFR 50.61.

During the aging management program audit (ADAMS Accession No. ML17054C529), the staff noted that the applicant's TLAA on PTS is based on the updated PTS analysis in WCAP-18002-NP, Revision 0, "Waterford Unit 3 Time-Limited Aging Analysis on Reactor Vessel Integrity," July 2015. The staff also noted that this report indicates that the $RT_{NDT(U)}$ or initial RT_{NDT} of lower shell plate M-1004-2 is updated from 22 °F to 0 °F in the analysis.

The WCAP report further indicates that this update is based on drop weight and transverse-orientation Charpy impact test data per ASME Code Section III, NB-2300. The report indicates that the previous value of 22 °F was based on NRC Branch Technical Position (BTP) MTEB 5-2, which is now BTP 5-3 in NUREG-0800 (2007). The staff noted that the previously determined initial RT_{NDT} value (22 °F) is also described in Section 5 of WCAP-16088-NP, Revision 1, "Waterford Unit 3 Reactor Vessel Heatup and Cooldown Limit Curves for Normal Operation," September 2003 (ADAMS Accession No. ML041620063).

In its review, the staff noted that the LRA (including LRA Table 4.2-3) does not describe a specific provision of ASME Code Section III, NB-2331, that the applicant used in updating the initial RT_{NDT} value of lower shell plate M-1004-2. The staff determined that additional information was needed to confirm that the applicant's test data were appropriately used in updating the initial RT_{NDT} values for the following beltline materials: (a) intermediate shell plates M-1003-1, M-1003-2, and M-1003-3; and (b) lower shell plates M-1004-1 and M-1004-3.

By letter dated November 7, 2016, the staff issued RAI 4.2.3-1 requesting that, in order to demonstrate that the applicant's test data were appropriately used in updating the initial RT_{NDT} values of the beltline materials discussed above, the applicant describe the specific provision of ASME Code Section III, NB-2331, for each material. The staff also requested that the applicant provide the temperature representing a minimum of 50 ft-lb absorbed energy and 35 mil lateral expansion as obtained in transverse-orientation Charpy impact tests (T_{Cv}) for each material if such temperature was determined in the evaluation of material properties.

In its response dated February 6, 2017, the applicant indicated that although the historical values of initial RT_{NDT} were determined by using BTP MTEB 5-2 and longitudinal Charpy impact test data, transverse test data are available for the nine reactor vessel beltline plates listed in the LRA (i.e., lower shell plates M-1004-1, -2, -3; intermediate shell plates M-1003-1, -2, -3; and upper shell plates M-1002-1, -2, -3). The applicant also indicated that these beltline plates are projected to have a neutron fluence level exceeding 1×10^{17} n/cm^2 (E > 1 MeV) at the end of the period of extended operation. The applicant further indicated that these transverse Charpy impact test data were used to determine the initial RT_{NDT} values of reactor vessel beltline plates in accordance with the provisions of ASME Code Section III, NB-2331. The ASME Code provisions in Section III, NB-2331, are summarized as follows:

- Paragraph (a)(2): T_{NDT} (nil-ductility transition temperature by drop weight tests) is the initial RT_{NDT} if each specimen of the Charpy impact (C_v) test exhibits at least 35 mils (0.89 mm) lateral expansion and absorbed energy not less than 50 ft‑lb at a temperature not greater than T_{NDT} + 60 °F.
- Paragraph (a)(3): When paragraph (a)(2) is not met, additional C_v tests are conducted in groups of three specimens to determine the temperature T_{Cv} at which they are met. In this case, the initial RT_{NDT} is the higher of T_{NDT} and T_{Cv} –60 °F.
- Paragraph (a)(4): When a C_v test has not been performed at T_{NDT} + 60 °F or the C_v test at T_{NDT} + 60 °F does not exhibit a minimum of 50 ft‑lb and 35 mils lateral expansion, T_{Cv} may be determined from a full C_v impact curve developed from the minimum data points of all the C_v tests performed.

In addition, the applicant indicated that the test data necessary to use the ASME Code provisions are documented in Certified Material Test Reports (CMTRs) or the C-PENG-ER-004 report (October 1995). The applicant also clarified that the initial RT_{NDT} values for these plates were determined by using the Charpy impact test data directly or through application of a hyperbolic tangent curve fit of the test data.

In its response, the applicant further clarified that BTP MTEB 5-2 is no longer used to determine the initial RT_{NDT} values for the reactor vessel beltline materials. In addition, the applicant included the following information for each beltline plate: (1) T_{Cv} and T_{NDT} values, (2) initial RT_{NDT}, (3) overall limiting parameter in the determination of initial RT_{NDT} (T_{Cv} versus T_{NDT}), and (4) specific provision of ASME Code Section III, NB-2331, used to determine initial RT_{NDT}.

In its review, the staff noted that the applicant indicated that the initial RT_{NDT} value of lower shell plate M-1004-2 was determined in accordance with paragraph Section III, NB-2331 (a)(3), and that the T_{Cv} value of the plate material is 47 °F. However, the staff noted that Table 4 (page 124) of C-PENG-ER-004 does not identify 47 °F as a Charpy test temperature of the lower shell plate.

Therefore, it was not clear whether the applicant adequately identified the ASME Code provision that was used to determine the initial RT_{NDT} for the plate material. In addition, the staff noted that the T_{NDT} values of reactor vessel beltline plates provided in the applicant's response are not consistent with those described in FSAR Table 5.3-13 for plates M-1003-2, M-1003-3, M-1004-1, M-1004-2 and M-1004-3. For example, the FSAR table indicates T_{NDT} of intermediate shell plate M-1003-2 is −50 °F in contrast with −40 °F that is identified in the applicant's response.

By letter dated March 14, 2017, the staff requested that the applicant provide justification for why Table 4 of C-PENG-ER-004, Revision 0, Volume 1 does not identify 47 °F as a Charpy impact test temperature for plate M-1004-2 in contrast with the applicant's claim that the initial RT_{NDT} of the plate was determined in accordance with paragraph (a)(3) of ASME Code Section III, NB-2331. The staff also requested that the applicant explain how the T_{Cv} value of the M-1004-2 plate (i.e., 47 °F) was determined. In addition, the staff requested that the applicant resolve the inconsistencies regarding the T_{NDT} values of reactor vessel beltline plates between the applicant's response and FSAR Table 5.3-13.

In its response dated April 11, 2017, the applicant provided the following information regarding the determination of T_{Cv} and RT_{NDT} for plate M-1004-2: The C-PENG-ER-004 Report identified that, at the test temperature of 40 °F, the 50 ft-lb absorbed energy criterion of ASME Code

Section III, NB-2331, paragraph (a)(2), was not satisfied. Both the 50 ft-lb energy and 35 mils lateral expansion criteria were satisfied at the test temperature of 100 °F. In order to avoid over-conservatism, paragraph (a)(4) of ASME Code Section III, NB-2331, was utilized. The curve-fit of transverse Charpy impact test data showed that the T_{Cv} value where both criteria were satisfied was 47 °F. In addition, the provision in paragraph (a)(3) was used to determine the initial RT_{NDT} value as the greater of T_{NDT} and T_{Cv} − 60 °F.

In its review, the staff finds this portion of the applicant's response acceptable because the applicant provided the correct reference to the ASME Code provision that was used to determine the T_{Cv} value (47 °F) for the lower shell plate M1004-2, and the applicant clarified that the initial RT_{NDT} value (0 °F) was determined as the greater of T_{NDT} and T_{Cv} − 60 °F in accordance with ASME Code Section III, NB-2331.

The applicant also indicated that the updated T_{NDT} values of the reactor vessel plates M-1003-2, M-1003-3, M-1004-1, M-1004-2, and M-1004-3 are based on the use of additional drop weight test data not previously considered, including data from C-PENG-ER-004, TR-C-MCS-002 (surveillance capsule material baseline report) and their source CMTRs. The applicant further clarified that the previous values of T_{NDT} were based only on a portion of the drop weight test data. In addition, the applicant indicated that the additional drop weight test data have been incorporated into the FSAR through the licensing basis document change.

In its review, the staff finds the applicant's response regarding T_{NDT} values acceptable because the applicant clarified that: (1) the updated T_{NDT} values of the reactor vessel plates are based on the use of the additional drop weight test data, and (2) the previous T_{NDT} values were based only on a portion of relevant test data. In addition, the staff noted that the updated T_{NDT} value of each plate is greater than the previous value of T_{NDT}, which means a conservative update to T_{NDT}. Therefore, the staff's concern described in RAIs 4.2.3-1 and 4.2.3-1a is resolved.

Based on the clarification of T_{NDT} and T_{Cv} values discussed above, the staff finds that the changes to the initial RT_{NDT} values for reactor vessel plates are valid for use in the RT_{PTS} calculations of the components. The staff finds these changes acceptable because they are in compliance with the methods for establishing RT_{NDT} values described in ASME Code Section III.

In addition, the staff finds that the applicant adequately determined that the limiting RT_{PTS} for base metal and longitudinal welds at 55 EFPY is 57 °F (upper shell plate M-1002-2) and the limiting RT_{PTS} for circumferential welds at 55 EFPY is 73 °F (upper-to-intermediate shell circumferential weld 106-121, Heat No. 3P4767). The staff finds that these limiting RT_{PTS} values meet the acceptance criteria of 10 CFR 50.61 (i.e., 270 °F and 300 °F respectively) and, therefore, are acceptable.

Based on its review, the staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the PTS analysis for the reactor vessel has been projected to the end of the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.2.2.1.2.2 because the applicant projected the PTS analysis in accordance with the requirements, including the analysis methods, in 10 CFR 50.61.

4.2.3.3 FSAR Supplement

LRA Section A.2.1.3 provides the FSAR supplement summarizing the TLAA on PTS for the reactor vessel. The staff reviewed LRA Section A.2.1.3, consistent with the review procedures in SRP-LR Section 4.2.3, which states that the applicant should provide a summary description

of the evaluation of the reactor vessel neutron embrittlement. On the basis of its review of the FSAR supplement, the staff determined that the applicant provided an adequate summary description of the actions to address the PTS analysis, 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 PTS analysis for the reactor vessel has been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.4 Pressure-Temperature Limits

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 describes the applicant's TLAA related to the plant-specific pressure-temperature (P-T) limit analysis for WF3. The applicant stated that the P-T limit analyses are required to be performed in accordance with the regulatory requirements in 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," and subject to the limiting condition of operation (LCO) requirements in TS LCO Section 3.4.8.1. The applicant stated that the current licensed P-T limit heatup and cooldown curves for 32 EFPY are included in TS Figures 3.4-2 and 3.4-3.

The applicant stated that, in accordance with TS Surveillance Requirement Section 4.4.8.1.2, RPV surveillance capsules and their test specimens are required to be removed and examined at the intervals specified in the RPV surveillance capsule withdrawal schedule, which is within the scope of the applicant's Reactor Vessel Surveillance program (LRA AMP B.1.34). The applicant stated that the current licensed RPV surveillance capsule withdrawal schedule for the facility is defined in FSAR Table 5.3-10 and that the schedule was approved in accordance with the requirements in 10 CFR Part 50, Appendix H. The applicant explained that applicable testing of the test specimens in the capsules is performed to determine changes in the properties of the ferritic steel materials used to fabricate the pressure-retaining base metal and weld components in the RPV. The applicant also explained that these test results are incorporated into the safety analyses that are included in any license amendment request (LAR) packages for updating the P-T limit heatup and cooldown curves located in TS Figures 3.4-2 and 3.4-3. The applicant identified that the 83° capsule (azimuthal position in the reactor vessel) was the latest surveillance capsule removed in accordance with the withdrawal schedule and that the capsule was removed at approximately 24.7 EFPY.

The applicant stated that the analyses needed to establish the P-T limit curves for the period of extended operation will be performed before the expiration of the P-T limit curves for 32 EFPY using two different regulatory processes:

(1) the process for implementing the applicant's Reactor Vessel Surveillance program (LRA AMP B.1.34) in accordance with the requirements of 10 CFR Part 50, Appendix H

(2) the process for submitting 10 CFR 50.90 LARs for updating the P-T limit heatup and cooldown curves in TS Figures 3.4-2 and 3.4-3

The applicant used these processes to disposition the TLAA on P-T limits in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of loss of fracture toughness due to

neutron irradiation embrittlement on the intended pressure boundary functions of the RPV and RCPB will be adequately managed during the period of extended operation.

4.2.4.2 Staff Evaluation

The staff reviewed the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) consistent with the acceptance criteria in SRP-LR Section 4.2.2.1.3.3 and the review procedures in SRP-LR Section 4.2.3.1.3.3, which state that updated P-T limits for the period of extended operation must be available before entering the period of extended operation. These SRP-LR sections also state that the 10 CFR 50.90 license amendment process for updating P-T limit curves located in the TS LCOs can be considered an adequate process within the scope of 10 CFR 54.21(c)(1)(iii), such that valid P-T limit curves will be maintained throughout the period of extended operation.

The staff determined that the applicant's basis for updating the P-T limits is consistent with the acceptance criteria in SRP-LR Section 4.2.2.1.3.3 for CLBs that include the respective P-T limit curves in the LCOs of the plant-specific TS for the facilities because: (a) the applicant will update its P-T limit curves that will be needed for the period of extended operation in accordance with the applicant's regulatory process for submitting 10 CFR 50.90 LARs and for implementing the Reactor Vessel Surveillance program in accordance with the requirements of 10 CFR Part 50, Appendix H; (b) the applicant will update the P-T limit curves prior to the expiration of the current P-T limit curves for 32 EFPY located in TS Figures 3.4-2 and 3.4-3; and (c) this provides an acceptable basis for meeting the requirements in 10 CFR 54.21(c)(1)(iii). Thus, the TLAA associated with the P-T limits will be adequately managed during the period of extended operation, consistent with the criteria in SRP-LR Sections 4.2.2.1.3.3 and 4.2.3.1.3.3.

4.2.4.3 FSAR Supplement

LRA Section A.2.1.4 provides the FSAR supplement summarizing the TLAA on P-T limits. The staff reviewed LRA Section A.2.1.4 consistent with the acceptance criteria in SRP-LR Section 4.2.2.2 and the review procedures in SRP-LR Section 4.2.3.2. The review procedures state that the staff should verify that the applicant has provided information to be included in the FSAR supplement that includes a summary description of the evaluation of the reactor vessel neutron embrittlement TLAAs, which include the TLAA for P-T limits. SRP-LR Section 4.2.3.2 also states that the staff should verify that the FSAR supplement summary for this TLAA information is equivalent to that in SRP-LR Table 4.2-1.

The staff confirmed that the applicant's FSAR supplement summary description for this TLAA was consistent with the information for the TLAA in LRA Section 4.2.4 and provided information similar to that provided for this type of TLAA in SRP-LR Table 4.2-1. The staff also confirmed that the applicant's FSAR supplement summary description provided an adequate explanation of the applicant's regulatory processes for implementing 10 CFR 50.90 LARs and the applicant's Reactor Vessel Surveillance program are being used to disposition this TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.2.2.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of the TLAA on P-T limits, as required by 10 CFR 54.21(d).

4.2.4.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the TLAA on P-T limits will be adequately managed through the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Low-Temperature Overpressure Protection (LTOP) Setpoints

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 describes the applicant’s TLAA related to the plant-specific LTOP setpoint analysis for WF3. The applicant stated that an operating shutdown cooling loop, connected to the RCS, provides overpressure relief capability and will prevent overpressurization of the RCS. The applicant stated that requirements for implementing this LTOP system are governed by the LCOs and surveillance requirements in TS Sections 3/4.4.2.

The applicant stated that activation of this LTOP system provides a diverse means of protection against RCS overpressurization at low temperatures, and that overpressure protection is accomplished by a relief valve located in each shutdown cooling loop (refer to FSAR Section 5.2B.3). The applicant also stated that the calculations (analysis) for establishing the LTOP system activation setpoints are considered part of the P-T limit analyses for WF3. The applicant stated that the P-T limit curves are updated before exceeding the applicability period for the current P-T limits located in the plant TS (refer to P-T limit heatup and cooldown curves for 32 EFPY located in TS Figures 3.4-2 and 3.4-3), and that this is accomplished through the applicant’s implementation of the 10 CFR 50.90 license amendment process and the Reactor Vessel Surveillance program (LRA AMP B.1.34).

The applicant dispositioned the TLAA on LTOP in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the RCS will be adequately managed during the period of extended operation.

4.2.5.2 Staff Evaluation

Table 4.1-3 in SRP-LR Section 4.1 identifies that an LTOP analysis may be applicable to the CLB and may need to be identified as a plant-specific TLAA. The staff noted that it was appropriate for the applicant to identify the LTOP system setpoint analysis as a TLAA because (a) WF3 is designed with a RCS pressure relief path that constitutes the LTOP system for the facility, and (b) the corresponding LTOP setpoint analysis for the system meets all six criteria for defining a TLAA in 10 CFR 54.3(a).

The staff reviewed the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the acceptance criteria in SRP-LR Sections 4.7.2.1 and 4.2.2.1.3.3 and the review procedures in SRP-LR Section 4.7.3.1.3, which state that under this option, the applicant proposes to manage the aging effects associated with the TLAA by an AMP (or regulatory process) in the same manner as described for implementing the integrated plant assessment (IPA) process in 10 CFR 54.21(a). The SRP-LR states that the staff reviews the applicant’s AMP or aging management process 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.

The staff noted that the applicant identified that it will update its LTOP system activation setpoint analysis when the applicant performs its updates of the plant-specific P-T limit heatup and cooldown curves for WF3. As documented in SER Section 4.2.4, the applicant dispositioned the P-T limits TLAA in accordance with 10 CFR 54.21(c)(1)(iii). Therefore, the staff finds that the applicant's processes for implementing 10 CFR 50.90 license amendment requirements and the Reactor Vessel Surveillance program (LRA AMP B.1.34) may also be used to manage the LTOP TLAA in accordance with 10 CFR 54.21(c)(1)(iii), because it is consistent with the staff's evaluation provided in SER Section 4.2.4. The staff also finds the LTOP TLAA acceptable because the applicant will update both the P-T limit and LTOP activation setpoint analyses for WF3, (a) using these processes prior to the expiration of the current P-T limit heatup and cooldown curves in the CLB, and (b) consistent with the acceptance criteria in SRP-LR Section 4.2.2.1.3.3. The staff finds that the applicant has provided an acceptable basis for demonstrating compliance with the criteria in 10 CFR 54.21(c)(1)(iii), thus demonstrating that the LTOP TLAA will be adequately managed during the period of extended operation.

4.2.5.3 FSAR Supplement

LRA Section A.2.1.5 provides the FSAR supplement summarizing the TLAA on LTOP. The staff reviewed LRA Section A.2.1.5 consistent with the acceptance criteria in SRP-LR Section 4.7.2.2 and the review procedures in SRP-LR Section 4.7.3.2, which state that the staff should verify that the applicant has provided information to be included in the FSAR supplement that includes summary descriptions of the plant-specific TLAAs, which include the LTOP TLAA. SRP-LR Section 4.7.3.2 also states that the description should contain information that the plant-specific TLAA has been dispositioned for the period of extended operation.

The staff confirmed that the applicant's FSAR supplement summary description provided sufficient information on the basis for the TLAA on LTOP disposition in accordance with 10 CFR 54.21(c)(1)(iii). The staff noted that the FSAR supplement in LRA Section A.2.1.5 adequately explains that the LTOP system activation setpoint analysis for WF3 will be updated when the applicant updates the P-T limit heatup and cooldown curves analyses for WF3, and through reference to the FSAR supplement in LRA Section A.2.1.4, provides a sufficient explanation on why the processes for implementing 10 CFR 50.90 license amendment requirements and the applicant's Reactor Vessel Surveillance program serve as an acceptable basis for accepting the TLAA on LTOP in accordance with 10 CFR 54.21(c)(1)(iii).

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in both SRP-LR Section 4.7.2.2 and SRP-LR Section 4.2.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of the TLAA on LTOP, 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 has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the LTOP TLAA will be adequately managed during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3 <u>Metal Fatigue</u>

4.3.1 Class 1 Fatigue

<u>Summary of Technical Information in the Application</u>

LRA Section 4.3.1 describes the applicant's TLAA for ASME Code Class 1 components. The LRA states that the major Class 1 components at WF3 include the reactor vessel, pressurizer, RCPs, SGs, control rod drives, and associated piping and valves. In accordance with ASME Code Section III requirements, fatigue evaluations were performed to calculate a cumulative usage factor (CUF) for each of these Class 1 components or subcomponents. The LRA states that these fatigue evaluations were based on a specified number of design cycles that were assumed for a 40-year license term; therefore, these CUF calculations are considered TLAAs.

The LRA states that the applicant evaluated the design cycles and plant operating history to determine the number of cycles that had occurred at the plant as of April 5, 2014. The LRA further states that the rate of transient occurrence was used to project the number of cycles that would occur through 60 years of operation. Table 4.3-1, "Projected and Analyzed Transient Cycles," provides the transients being tracked, the analyzed cycle limits, the accrued number of cycles, and projected 60-year cycles. The LRA states that the Fatigue Monitoring program will monitor these transient cycles and assure corrective action is taken before the analyzed cycle limits are exceeded.

The applicant dispositioned the TLAA for the Class 1 fatigue evaluations in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

<u>Staff Evaluation</u>

The staff reviewed the applicant's TLAA for Class 1 fatigue evaluations 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

LRA Section 4.3.1 states that the transient cycles needed to be tracked for the fatigue evaluations of these Class 1 components are listed in LRA Table 4.3-1. This table includes: (1) the number of cycle occurrences as baselined as of April 5, 2014, (2) the 60-year projected number of cycles, and (3) the analyzed cycle limit. The applicant states that the Fatigue Monitoring program monitors and tracks these transient cycles and includes corrective actions before exceeding the cycle limits. The LRA also states that FSAR Table 3.9-3, "Transients and Operative Conditions for Code Class 1 Non-NSSS Piping," lists the transients used as inputs to the piping stress analyses. During its review, the staff noted that both of these tables includes the transient, "Loss of Charging," as a transient that was used in the stress analyses and that will be monitored during the period of extended operation by the Fatigue Monitoring program. However, the staff noted that FSAR Table 3.9-3 states the cycle limit of the "Loss of Charging" transient is 100, whereas LRA Table 4.3-1 states that the cycle limit is 200. The staff questioned why the applicant will not be monitoring the most conservative cycle limit used in the stress analyses and by letter dated October 12, 2016, issued RAI 4.3.1-1, requesting that the applicant clarify the discrepancy between the two listed cycle limits.

By letter dated November 10, 2016, the applicant responded to RAI 4.3-1. In its response, the applicant stated that the cycle limit of 100, as listed in FSAR Table 3.9-3, was the value originally used in the piping analyses. However, the applicant stated that the piping analysis of record uses a cycle limit of 200. The applicant stated that it has initiated an engineering change to update FSAR Table 3.9-3 to reflect the current cycle limit of 200. The staff finds the applicant's response acceptable because the applicant: (a) clarified the discrepancy between the two cycle limits,(b) initiated actions to update the appropriate FSAR tables, and (c) is using the cycle limit that is in the current stress analyses in its CLB. The staff also noted that the current baselined cycle count of this transient is four with a 60-year projected cycle count of eight. The staff noted that there is significant margin to the original cycle limit of 100. The staff's concerns in RAI 4.3.1-1 are resolved.

The staff also noted that in its response to RAI 4.3.1.2-a by letter dated March 16, 2017, the applicant added to LRA Table 4.3-1 the "loss of secondary pressure transient" that is applicable to its leak before break (LBB) TLAA. The staff's evaluation of this addition is documented in SER Section 4.7.2.2.

The staff finds it appropriate that the applicant proposed to credit its Fatigue Monitoring program to manage the transient cycles in LRA Table 4.3-1. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the reactor vessel components. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated that, pursuant to 10 CFR 54.21(c)(1)(iii), the transient cycles that contribute to fatigue usage will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 includes corrective actions prior to exceeding the number of transient cycles used in the analysis.

FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the Class 1 components. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of Class 1 components, as required by 10 CFR 54.21(d).

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 design transients and cycles will be adequately monitored and cumulative fatigue usage will be adequately managed by the Fatigue

Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.1 Reactor Vessel

4.3.1.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1.1 describes the applicant's TLAA for the fatigue evaluations of reactor vessel components. The LRA states that the reactor vessel was designed to ASME Code Section III, Class 1 through Summer 1971 Addenda. The applicant replaced the original reactor vessel head. The LRA states that: (1) the transient cycles that affect the reactor vessel design are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the reactor vessel and replacement head are less than 1.0.

The applicant dispositioned the reactor vessel and reactor vessel head fatigue TLAAs in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor vessel 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the reactor vessel components. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the reactor vessel components will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.1.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the reactor vessel. The staff reviewed LRA Section A.2.2.1 consistent with the review

procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the reactor vessel, as required by 10 CFR 54.21(d).

4.3.1.1.4 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 metal fatigue on the intended functions of the reactor vessel will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.2 Reactor Vessel Internals

4.3.1.2.1 Summary of Technical Information in the Application

LRA Section 4.3.1.2 describes the applicant's TLAA for the fatigue evaluations of RVI components. The LRA states that, as described in FSAR Section 3.9.5, the stress analysis was performed using the design fatigue curves in ASME Code Section III in the design of critical RVI components. The LRA states that: (1) the transient cycles that affect reactor vessel internal components are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the reactor vessel internals are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the RVI in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient

cycle limits used in the fatigue evaluations of the RVI components. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated pursuant to 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 for the period of extended operation, and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.2.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for RVI components. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the RVI, as required by 10 CFR 54.21(d).

4.3.1.2.4 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)(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 FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.3 Pressurizer

4.3.1.3.1 Summary of Technical Information in the Application

LRA Section 4.3.1.3 describes the applicant's TLAA for the fatigue evaluations of the pressurizer. The LRA states that the pressurizer was designed to ASME Code Section III, Class 1, through Summer 1971 Addenda. The LRA states that: (1) the transient cycles that affect the pressurizer are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the pressurizer are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the pressurizer in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the pressurizer 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the pressurizer components. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the pressurizer will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.3.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the pressurizer. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the pressurizer, as required by 10 CFR 54.21(d).

4.3.1.3.4 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)(iii), that the effects of metal fatigue on the intended functions of the pressurizer will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.4 Steam Generators

4.3.1.4.1 Summary of Technical Information in the Application

LRA Section 4.3.1.4 describes the applicant's TLAA for the fatigue evaluations of the replacement steam generators (SGs). The LRA states that the replacement SGs were designed to ASME Code Section III, Class 1, 1998 Edition through 2000 Addenda. The LRA states that: (1) the transient cycles that affect the replacement SGs are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the replacement SGs are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the replacement SGs in accordance with 10 CFR 54.21(c)(1)(iii) to demonstrate 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.

4.3.1.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the replacement SG 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the replacement SGs. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the replacement SGs will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.4.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the replacement SGs. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the replacement SGs, as required by 10 CFR 54.21(d).

4.3.1.4.4 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 metal fatigue on the intended functions of the replacement SGs will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.5 Control Element Drive Mechanisms

4.3.1.5.1 Summary of Technical Information in the Application

LRA Section 4.3.1.5 describes the applicant's TLAA for the fatigue evaluations of control element drive mechanisms (CEDMs). The LRA states that these components are designed to ASME Code Section III, Class 1, 1998 Edition and 2000 Addenda. The LRA states that: (1) the transient cycles that affect the CEDMs are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the CEDMs are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the CEDMs in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.5.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the CEDMs 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the CEDMs. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the CEDMs will be adequately managed for the period of extended operation; and (b) the applicant's TLAA

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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.5.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the CEDMs. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the CEDMs, as required by 10 CFR 54.21(d).

4.3.1.5.4 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 metal fatigue on the intended functions of the CEDMs will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.6 Reactor Coolant Pumps

4.3.1.6.1 Summary of Technical Information in the Application

LRA Section 4.3.1.6 describes the applicant's TLAA for the fatigue evaluations of reactor coolant pumps (RCPs). The LRA states that the pump casings were designed to ASME Code Section III, Class 1, through Winter 1971 Addenda. The LRA states that: (1) the transient cycles that affect the RCPs are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the RCPs are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the RCPs in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.6.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the RCPs 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the RCPs. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the RCPs will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.6.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the RCPs. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the RCPs, as required by 10 CFR 54.21(d).

4.3.1.6.4 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 metal fatigue on the intended functions of the RCPs will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.7 Reactor Coolant System Class 1 Piping

4.3.1.7.1 Summary of Technical Information in the Application

LRA Section 4.3.1.7 describes the applicant's TLAA for the fatigue evaluations of reactor coolant loop piping. The LRA states that: (1) the transient cycles that affect the reactor coolant loop piping are included in LRA Table 4.3-1, (2) these transients will be monitored by the Fatigue Monitoring program, and (3) the calculated CUFs for the reactor coolant loop piping are less than 1.0.

The applicant dispositioned the TLAA for the fatigue evaluations of the reactor coolant loop piping in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.1.7.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the reactor coolant loop piping 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, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The staff reviewed FSAR Section 3.9.1.1.2 and noted that the WF3 plant design includes large bore Class 1 valves that were designed to the applicable requirements in the 1971 Edition of ASME Code Section III, inclusive of the 1972 Winter Addenda. The staff further noted that these Class 1 valves were analyzed for the applicable cyclical loading analyses. The staff also reviewed FSAR Section 5.4.12, which confirmed that the cyclical loading analyses for these types of valves were included in the CLB. Although LRA Section 4.3.1.7 discusses the metal fatigue analyses for Class 1 piping, it does not mention the large bore Class 1 valves within the scope of the metal fatigue analyses for Class 1 piping components. By letter dated October 12, 2016, the staff issued RAI 4.1-1, requesting that the applicant clarify how the LRA addresses the metal fatigue TLAA for large bore Class 1 valves.

By letter dated November 10, 2016, the applicant responded to RAI 4.1-1. In its response, the applicant confirmed that Class 1 valve fatigue analyses were evaluated as TLAAs. The applicant also amended LRA Sections 4.3.1.7 and A.2.2.1 to clarify that the metal fatigue TLAA evaluations cover Class 1 piping and valves. The staff finds the applicant's response acceptable because the applicant clarified the discrepancies between the FSAR and the LRA and amended the LRA appropriately to include the metal fatigue TLAA evaluation of the Class 1 vales that are within the scope of license renewal. The staff's concerns in RAI 4.1-1 are resolved.

The LRA states that the Fatigue Monitoring program will be used to manage the effects of aging due to fatigue. The staff finds it appropriate that the applicant proposed to manage metal fatigue of these components using its Fatigue Monitoring program. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff determined that this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the reactor coolant loop piping and valves. The program performs these actions consistent with GALL Report AMP X.M1.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of the reactor coolant loop piping and valves will be adequately managed for the period of extended operation; and (b) the applicant's TLAA 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 prior to exceeding the number of transient cycles used in the analysis.

4.3.1.7.3 FSAR Supplement

LRA Section A.2.2.1 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for the reactor coolant loop piping. The staff reviewed LRA Section A.2.2.1 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

As discussed in SER Section 4.3.1.7.2, the applicant amended LRA Section A.2.2.1 to clarify that metal fatigue analyses for RCS Class 1 valves were evaluated as TLAAs.

Based on its review of the FSAR supplement, as amended by letter dated November 10, 2016, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of the reactor coolant loop piping and valves, as required by 10 CFR 54.21(d).

4.3.1.7.4 *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)(iii), that the effects of metal fatigue on the intended functions of the reactor coolant loop piping and valves will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2 Non-Class 1 Mechanical Systems

4.3.2.1 Non-Class 1 Pressure Boundary Piping Using Stress Range Reduction Factors

4.3.2.1.1 Summary of Technical Information in the Application

LRA Section 4.3.2.1 describes the applicant's TLAA for non-Class 1 piping and in-line components. For ASME Code Section III, Classes 2 and 3, and ANSI B31.1 piping systems, a stress range reduction factor is incorporated to determine acceptability of the piping design with respect to thermal stresses. A stress range reduction factor is applied to the allowable stress range if the number of thermal cycles exceeds 7,000. The LRA states that for piping and in-line components of the systems that are subjected to elevated temperatures above the fatigue threshold, the thermal cycles have been projected for 60 years of operation. The applicant stated that the projected thermal cycles will not exceed the 7,000 thermal cycle limit, therefore, the non-Class 1 pipe stress calculations will remain valid for the period of extended operation. The applicant dispositioned the TLAA for non-Class 1 piping and in-line components in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the period of extended operation.

4.3.2.1.2 Staff Evaluation

The staff reviewed the applicant's TLAA for non-Class 1 piping and in-line components 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, which states that the staff reviews the relevant information in the TLAA, operating plant transient history, design basis, and CLB to verify that the maximum allowable stress range values for the existing fatigue analysis remain valid for the period of

extended operation and the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

The LRA states that the cycles will not exceed 7,000 thermal cycles. However, the staff noted that the LRA did not identify which thermal transients and their 60-year projected cycle counts determine the accumulated thermal cycles. The staff needed additional information to confirm the applicant's basis that the non-Class 1 pipe stress calculations will remain valid for the period of extended operation. By letter dated February 14, 2017, the staff issued RAI 4.3.2-2 requesting the applicant to justify that the 7,000 thermal cycle limit will not be exceeded during the period of extended operation such that the stress calculations will remain valid for these non-Class 1 piping and in-line components.

By letter dated March 16, 2017, the applicant responded to RAI 4.3.2-2. In its response, the applicant provided the non-Class 1 pressure boundary piping systems. The piping systems the applicant identified were the containment spray, safety injection, containment penetrations, chemical and volume control system, emergency diesel generator (EDG) system, fire protection: water system, auxiliary diesel generator, main feedwater system, main steam system, and nonsafety-related affecting safety-related system. The applicant also identified the thermal transients for each of these piping systems. These piping systems, with the exceptions noted below, include thermal transients that are being monitored by the Fatigue Monitoring program. The staff reviewed the thermal transients of these piping systems and confirmed that 7,000 cycles will not be exceeded without corrective actions from the Fatigue Monitoring program.

For the EDG system, the applicant stated that the EDGs are tested monthly and every 18 months with actual actuation occurring less frequently than the testing. The staff notes that there is sufficient margin between the expected number of thermal cycles and the 7,000 thermal cycle limit and accepts the applicant's basis.

For the fire protection water system, the applicant stated that the diesel-driven fire pumps are tested monthly with actual actuation occurring less frequently than the testing. The staff notes that there is sufficient margin between the expected number of thermal cycles and the 7,000 thermal cycle limit. Therefore, the staff finds the applicant's basis acceptable.

For the auxiliary steam system, which was identified as a nonsafety-related affecting safety-related system, the applicant stated that the system cycles several times a year as environmental conditions change. The applicant stated that it assumed 100 thermal cycles a year, which would project to 6,000 cycles at the end of the period of extended operation. The staff noted that, within typical plant operation, the assumed 6,000 thermal cycles during the period of extended operation is reasonable with a sufficient margin to the cycle limit of 7,000. Therefore, the staff finds the applicant's basis acceptable.

Based on the discussion above, the staff finds the applicant's response to RAI 4.3.2-2 acceptable because the applicant identified the non-Class 1 systems and the applicable thermal transients and justified that the thermal cycle limit of 7,000 will not be exceeded during the period of extended operation. The staff's concerns in RAI 4.3.2-2 are resolved.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the non-Class 1 pipe fatigue analysis will remain valid for the period of extended operation. Additionally, the staff finds that the applicant meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the applicant's operating plant transient history provides

reasonable assurance that the thermal cycles for the non-Class 1 piping and in-line components will not exceed 7,000 cycles during the period of extended operation.

4.3.2.1.3 FSAR Supplement

LRA Section A.2.2.2 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for non-Class 1 piping and in-line components. The staff reviewed LRA Section A.2.2.2 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of non-Class 1 piping and in-line components, as required by 10 CFR 54.21(d).

4.3.2.1.4 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that the metal fatigue analyses for non-Class 1 piping and in-line components remain valid for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2.2 Flex Connections and Expansion Joints

4.3.2.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2.2 describes the applicant's TLAA for mechanical flexible connectors and expansion joints that are within the scope of license renewal. The LRA states that it reviewed its fatigue analyses and identified TLAAs for EDG intake air and exhaust expansion joints. The LRA states that these flexible connectors were qualified for at least 15,000 cycles and that the startup cycles of the diesels will not exceed this limit.

The applicant dispositioned the TLAA for the mechanical flexible connectors and expansion joints in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the period of extended operation.

4.3.2.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the mechanical flexible connectors and expansion joints 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, which states that the staff reviews the relevant information in the TLAA, operating plant transient history, design basis, and CLB to verify that the allowable limit for full thermal range transients will not be exceeded during the period of extended operation.

The LRA states that the EDG startup transient is the input for the fatigue analyses for the EDG intake air and exhaust expansion joints. The LRA states that these flexible connectors were qualified for at least 15,000 cycles, which exceeds the 60-year projected number of cycles. The staff noted that the LRA does not provide the exact baseline cycle counts or the projected

60-year projected cycle count of the EDG startups. However, based on operating experience, the staff noted that there should be a large margin between the projected 60-year EDG startups and the qualified cycle limit. The staff finds that the applicant's claim that the expected number of cycles during the period of extended operation would not exceed the 15,000 is reasonable.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(i), that the analyses for the mechanical flexible connectors and expansion joints remain valid for the period of extended operation.

Additionally, the applicant's evaluation meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.1 because the applicant's operating plant transient history and design basis provide reasonable assurance that the allowable limit for full thermal range transients for these mechanical flexible connectors and expansion joints will not be exceeded during the period of extended operation

4.3.2.2.3 FSAR Supplement

LRA Section A.2.2.2 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for mechanical flexible connectors and expansion joints. The staff reviewed LRA Section A.2.2.2 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of mechanical flexible connectors and expansion joints, as required by 10 CFR 54.21(d).

4.3.2.2.4 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)(i), that the fatigue analyses for the mechanical flexible connectors and expansion joints remain valid for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2.3 Non-Class 1 Heat Exchangers with Fatigue Analysis

4.3.2.3.1 Summary of Technical Information in the Application

LRA Section 4.3.2.3 describes the applicant's TLAA for non-Class 1 heat exchangers with fatigue analyses. The LRA states that design fatigue analyses for the letdown and regenerative heat exchangers were completed, even though these components are in the Class 1 portion of the system. The applicant stated that the cycle limits for these fatigue analyses are included in LRA Table 4.3-1 and will be managed by the Fatigue Monitoring program.

The applicant dispositioned the TLAA for non-Class 1 heat exchangers in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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.

4.3.2.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for non-Class 1 heat exchangers and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.3.3.1.2.3, which states that an AMP corresponding to GALL Report AMP X.M1 may be used to demonstrate acceptance of fatigue analyses in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

The staff noted that the LRA did not specify which transients were inputs to the fatigue analyses of these non-Class 1 heat exchangers. The staff needed additional information to determine if these transients were within the scope of the Fatigue Monitoring program. By letter dated October 10, 2016, the staff issued RAI 4.3.2-1, requesting that the applicant identify the applicable transients and justify that the Fatigue Monitoring program will manage these cycles throughout the period of extended operation.

By letter dated November 10, 2016, the applicant responded to RAI 4.3.2-1. The applicant stated that the following transients were used as inputs to the fatigue analyses of the letdown and regenerative heat exchangers: (1) plant loading 5 percent/minute, step increase 10 percent; (2) plant unloading 5 percent/minute, step decrease 10 percent; (3) maximum purification; (4) loss of load-reactor trip; (5) loss of charging; and (6) loss of letdown.

For the plant loading and unloading step change transients, the applicant stated that these transients were evaluated for 17,000 cycles, the existing analysis is valid because WF3 operates as a base-loaded plant.

For the maximum purification transient, the applicant stated that the transient was evaluated for 11,000 cycles. The applicant reviewed its plant data and determined that the transient had occurred approximately 200 times in 14 years, with a projected 60-year cycle count of 858. The applicant stated this transient does not require counting because the allowable number of cycles will not be exceeded during the period of extended operation. The staff finds this basis acceptable because there is a sufficiently large margin between the projected 60-year number of cycles based on plant operating history and the analyzed cycle limit.

The applicant stated that the loss of load-reactor trip, loss of charging, and loss of letdown transients are included in LRA Table 4.3-1 and will be managed by the Fatigue Monitoring program. The staff finds this acceptable because this program is capable of tracking the number of critical thermal and pressure transients and verifying that the severity of monitored transients are bounded by the design transient definitions. The program will also initiate corrective actions to prevent exceeding the transient cycle limits used in the fatigue evaluations of the non-Class 1 heat exchangers. The program performs these actions consistent with GALL Report AMP X.M1. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7. The staff's concerns in RAI 4.3.2-1 are resolved.

Therefore, the staff finds that: (a) the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of metal fatigue on the intended functions of non-Class 1 heat exchangers will be adequately managed for the period of extended operation; and (b) the applicant's TLAA meets the acceptance criteria in SRP-LR Section 4.3.2.1.2.3 because the applicant's Fatigue Monitoring program monitors and tracks the transient cycles assumed in the analysis and requires corrective action prior to exceeding the number of transient cycles used in the analysis.

4.3.2.3.3 FSAR Supplement

LRA Section A.2.2.2 provides the FSAR supplement summarizing the applicant's metal fatigue TLAA for non-Class 1 heat exchangers. The staff reviewed LRA Section A.2.2.2 consistent with the review procedures in SRP-LR Section 4.3.3.2, which states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the metal fatigue TLAA of non-Class 1 heat exchangers, as required by 10 CFR 54.21(d).

4.3.2.3.4 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)(iii), that the effects of metal fatigue on the intended functions of non-Class 1 heat exchangers will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Effects of Reactor Water Environment on Fatigue Life

4.3.3.1 Summary of Technical Information

LRA Section 4.3.3 describes the applicant's TLAA for its evaluation of the effects of the reactor coolant environment on component fatigue life for the period of extended operation. The LRA states that this evaluation assessed the impact of the reactor coolant environment on a sample of critical components for the plant. The applicant used NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," which identifies the locations of interest for consideration of environmental effects for CE plants. The LRA states that it applied environmentally assisted fatigue correction factors (F_{en}s) to the CUF evaluations for these identified locations. LRA Table 4.3-2 provides the results of the screening evaluation for these locations. The LRA states that the Fatigue Monitoring program will manage the effects of aging due to fatigue, including environmentally assisted fatigue (EAF), for the period of extended operation.

The applicant dispositioned the TLAA in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of EAF 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 26, 1999. The staff also identified that, consistent with Commission Order No. CLI-10-17, dated July 8, 2010 (ADAMS Accession No. ML101890775), 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 TLAA for EAF and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.3.3.1.3, which states that the reviewer verifies 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. For CE plants, NUREG/CR-6260 identified the following locations for evaluation of EAF:

(1) reactor vessel shell and lower head (two locations)
(2) reactor vessel inlet and outlet nozzles (two locations)
(3) surge line (two locations)
(4) charging system nozzle
(5) safety injection system nozzle
(6) shutdown cooling line

To determine the impact of the reactor coolant environment, the LRA states that it will apply F_{en} values to the CUF evaluations of these locations. The LRA states that the these F_{en} values will be calculated using NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels"; NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steel"; and NUREG/CR-6909, "Effect of LWR Coolant Environments on Fatigue Life of Reactor Materials."

In NUREG/CR-6909, the method used to calculate the "average temperature" is dependent on whether the minimum transient temperature exceeds the temperature threshold value of the material. When the minimum temperature exceeds the threshold temperature, the maximum and minimum temperature values of the stress cycle or load set pair are used to calculate the average temperature. When the minimum temperature is below the threshold temperature, the maximum and threshold temperature are used to calculate the average temperature. Sections 4.2.4 and 5.2.7 of NUREG/CR-6909 provide examples of determining average temperatures.

As noted above, NUREG/CR-6909 also states that the average temperature may be used to calculate the F_{en} value for transients with a constant strain rate and a linear temperature response, which are defined as "simple" transients. Use of an average temperature may not be appropriate for more complex transients that have multiple or non-linear temperature variations. For complex transients, the modified rate approach should be used to validate F_{en} calculations.

Because the applicant proposed using NUREG/CR-6909 to calculate the F_{en} values, the staff needed confirmation that the transient average temperatures will be calculated appropriately considering the threshold temperatures. The staff also needed confirmation that the average temperatures will be limited to simple transients. By letter dated October 12, 2016, the staff

issued RAI 4.3.3-3, requesting the applicant to provide the results of EAF calculations that used NUREG/CR-6909 and to justify that the guidelines were appropriately followed.

In its response, dated December 12, 2016, the applicant stated that it has not yet performed any EAF evaluations using NUREG/CR-6909. The staff reviewed LRA Table 4.3-2 and noted that none of the locations evaluated for EAF were made from nickel alloy, and therefore, NUREG/CR-6909 was not needed for those EAF calculations. The applicant further stated that for future EAF evaluations, it will ensure that EAF analyses that use NUREG/CR-6909: (1) will not use average temperature for complex transients, and (2) will use the maximum and threshold temperatures to calculate average temperature for simple transients when the minimum temperature is below the threshold temperature. The applicant amended its LRA and FSAR supplement to include this confirmation. The staff finds the applicant's response acceptable because: (1) the staff confirmed that the applicant's current EAF evaluation for the NUREG/CR-6260 locations did not require NUREG/CR-6909, and (2) the applicant updated its FSAR supplement to ensure that the appropriate guidelines in NUREG/CR-6909 will be followed for future EAF evaluations. The staff's concerns in RAI 4.3.3-3 are resolved.

The LRA also states that bounding F_{en} values were applied to the CUF evaluations to determine the projected 60-year environmentally-adjusted cumulative usage factor (CUF_{en}) of the NUREG/CR-6260 locations. However, the LRA does not provide enough information on how the bounding F_{en} values were calculated or how the applicant will ensure that these F_{en} values will remain bounding for the period of extended operation. By letter dated October 12, 2016, the staff issued RAI 4.3.3-1, requesting the applicant to: (a) describe how the bounding F_{en} values were determined for evaluating the NUREG/CR-6260 locations for environmental fatigue, and (b) justify how it will be assured that the variables and inputs for these F_{en} values will remain bounding throughout the period of extended operation.

In its response, dated December 12, 2016, the applicant provided the parameter inputs for its bounding F_{en} calculations and stated that it used two bounding F_{en} values for its NUREG/CR-6260 component locations. For low alloy steel components, the applicant stated that the dissolved oxygen in its RCS during normal operation is less than the threshold identified for oxygen by the Water Chemistry Control – Primary and Secondary program. The applicant stated that the dissolved oxygen parameter will be a zero term if the oxygen is less than this threshold. Therefore, the calculated F_{en} value for low alloy steel components will be bounding for the period of extended operation. For stainless steel locations, the applicant stated that it used the strain rate that generates the highest F_{en} value. The applicant further stated that, in its low oxygen environment, the calculated F_{en} value will not increase and will remain bounded for the period of extended operation. The staff noted the applicant's basis that if dissolved oxygen content is maintained below the identified threshold, the two calculated F_{en} values will be appropriately bounding for the period of extended operation. Therefore, the staff finds the applicant's response acceptable because: (a) the applicant provided the parameters used in its bounding F_{en} calculations, and (b) the Water Chemistry Control – Primary and Secondary program will ensure that the dissolved oxygen content will remain below the threshold such that the parameters used in these calculated F_{en} values will remain bounded for the period of extended operation. Therefore, the staff finds the applicant's response to this concern in RAI 4.3.3-1 acceptable.

The LRA states that the results of its EAF evaluation, as shown in LRA Table 4.3-2, identified two locations with a projected 60-year CUF_{en} value greater than the design limit of 1.0. The LRA states that for these two locations, refined EAF evaluations will be performed prior to the period of extended operations as part of the Fatigue Monitoring program. The applicant stated

that the original design basis fatigue calculations can include conservatisms and that it may revise these design calculations for those locations that exceed a CUF_{en} of 1.0. The LRA states that this update will refine fatigue analyses and include applying appropriate F_{en} factors to determine valid CUF_{en} values for the period of extended operation. The staff was unclear on what specific refinement methods would be used for these CUF_{en} evaluations and required additional information to determine if these refinement methods would be conservative and appropriate. By letter dated October 12, 2016, the staff issued RAI 4.3.3-1 and requested that the applicant identify and justify all of the methods that will be used to refine the CUF_{en} evaluations.

In its response, dated December 12, 2016, the applicant provided a list of methods that may be used to refine its EAF evaluations. The applicant stated that the refined fatigue analysis may evaluate the 60-year projected cycles with margin instead of the cycle limit assumed in the original calculations. The applicant stated that the Fatigue Monitoring program will still ensure that the actual cycle counts of these transients will not exceed the cycle limits. The staff finds this methodology acceptable because: (a) this method will provide a more accurate fatigue assessment based on current plant operations, (b) the Fatigue Monitoring program will monitor and track the actual cycle counts and provide corrective actions prior to the cycle counts exceeding the cycle limits.

The applicant also stated that refined analyses may use unbundled transients that had been bundled together for simplicity in previous analyses and may use more rigorous CUF_{en} calculation methods that will be performed in accordance with ASME Code provisions; therefore, the staff finds these methods acceptable.

The applicant also stated that the refined CUF_{en} analyses may: (a) review the specific loading and not just assume the worst case strain rate, and (b) utilize the actual metal sulfur content instead of assuming the bounding value. The staff determines that these methods are acceptable because the refined CUF_{en} evaluation methodology will provide a more accurate fatigue assessment based on current plant operations. Therefore, the staff finds the applicant's response to the concern in RAI 4.3.3-1 acceptable. The staff's concerns in RAI 4.3.3-1 are resolved.

The staff finds the applicant's EAF evaluation of the locations identified in NUREG/CR-6260 acceptable because the applicant: (a) evaluated each of the components identified in NUREG/CR-6260 for its plant design, (b) determined appropriately bounding F_{en} values for each component material, (c) identified the component locations with a 60-year projected CUF_{en} value greater than 1.0, and (d) will implement appropriate refinement methods applicable to its current plant configuration and consistent with ASME Code.

In its review of LRA Section 4.3.3, the staff also noted that additional locations based on plant-specific considerations must be evaluated to identify locations that may be more limiting than those identified in NUREG/CR-6260. The LRA states that design basis ASME Code Class 1 component fatigue evaluations will be reviewed to ensure that the most limiting components within the RCPB will be included in its EAF evaluations. However, the LRA did not provide its methodology to identify and evaluate the plant-specific locations that may be more limiting than the locations identified in NUREG/CR-6260. By letter dated October 12, 2016, the staff issued RAI 4.3.3-2 requesting the applicant to provide the methodology that will be used to identify plant-specific component locations in the RCPB that may be more limiting than the components identified in NUREG/CR-6260.

By letter dated December 12, 2016, the applicant responded to RAI 4.3.3-2 stating that its methodology will be based on EPRI Report 1024995, "Environmentally Assisted Fatigue Screening Process and Technical Basis for Identifying EAF Limiting Locations." The applicant stated that this screening process will determine the "sentinel" locations that will bound and appropriately represent each thermal zone.

However, EPRI Report 1024995 had not been submitted to the NRC for review and approval and, therefore, had not been endorsed by the NRC. The applicant did not define a plant-specific methodology and criteria used to select the most limiting locations for EAF. The applicant has not demonstrated that a plant-specific screening methodology has been developed in a manner that conservatively evaluates EAF effects, with the same degree of analytical rigor for all locations, to identify the bounding locations.

For the step in the methodology that computes the estimated EAF value (U_{en}* or CUF_{en}), the applicant stated in its response to RAI 4.3.3-2 that it will calculate U_{en}* using an F_{en} that is the average of the F_{en} determined for the strain rate of the predominant thermal transient and the maximum F_{en} determined by the minimum strain rate. The staff required clarification on the term "predominant thermal transient" and how it will be determined for each component, and how the resulting U_{en}* is a conservative value that can be used to compare the locations in an appropriate manner. Also, within each thermal zone, the applicant stated that "the CUF values are determined on a common basis (i.e., unbundled transients) so that valid rankings can be achieved." The staff required clarification on what specific parameters will be used. The staff needed additional information to determine if the components will be assessed similarly.

For the step in the methodology that examines the relative rankings and selects the sentinel locations, the staff also needed additional information to determine if the applicant's selection of sentinel locations within a thermal zone is conservative and appropriate. The applicant did not define the specific selection criteria in its "further study" to determine the sentinel locations. Also, the staff required clarification on the term "close-coupled" in terms of determining the number of sentinel locations within a thermal zone.

The applicant also did not identify if material type is one of the criteria when selecting sentinel locations (i.e., a sentinel location of one material can bound a location of a different material within a thermal zone). The staff noted that the U_{en}* of different materials may respond differently when the EAF is being refined in the future. The staff noted that refinement of the U_{en}* value sentinel location of one material may not correspond to an equivalent reduction of the U_{en}* value of a bounded location of a different material. The applicant did not justify that the refinement of the higher U_{en}* of one material would ensure the reduction of U_{en}* values for another material within the same transient section. By letter dated April 17, 2017, the staff issued RAI 4.3.3-2a, requesting that the applicant provide additional information and justification on its methodology and a basis to compare locations within thermal zones and select sentinel locations.

By letter dated May 12, 2017, the applicant responded to RAI 4.3.3-2a. In the first part of its response, the applicant stated that in its EAF evaluation, components in different thermal zones will not be compared with each other when determining sentinel locations. The staff finds this part of the response acceptable because the applicant's methodology compares components within thermal zones and the applicant will not need additional considerations across thermal zones.

In the second part of its response, the applicant defined the term “predominant thermal transient” as the thermal transient with the largest impact on fatigue usage. The applicant further stated that it will not use a screening F_{en} value that is the average of the F_{en} determined for the strain rate of the predominant thermal transient and the maximum F_{en} determined by the minimum strain rate. Instead, the applicant stated that it will calculate the F_{en} value used to screen components using realistic fluid dissolved oxygen levels, worst case metal strain rate, worst case sulfur in the metal, and the maximum metal service temperature. The staff finds this part of the response acceptable because the applicant: (a) will use actual operating values for the dissolved oxygen parameter, which will also be maintained by the Water Chemistry Control – Primary and Secondary program, (b) will use the most conservative values for the remaining parameters, and (c) the resulting F_{en} values used for screening are based on these appropriate and conservative values.

Also in the second part of its response, the applicant stated that when comparing CUF values for components, it will also consider: (a) ASME Code Section III, NB-3200 vs. NB-3600 analyses, (b) the degree of transient grouping, and (c) whether the same ASME Code fatigue curves were used. The applicant stated that when a refined fatigue analysis is used for one component, it will not screen out other components that have a lower CUF value but did not use the same level of refinement. The applicant stated that the parameters considered in the CUF value comparison and the conservative F_{en} calculations will provide a conservative and appropriate comparison between locations within the same thermal zone. The staff finds the applicant’s response acceptable because: (a) as discussed above, appropriate and conservative F_{en} values will be calculated; (b) the comparison parameters include refinement levels and ASME Code evaluations that will determine appropriate U_{en}^* values; and (c) will provide a meaningful sentinel location selection process that will compare locations on a similar basis.

In the third part of its response, the applicant defined the term “close-coupled” as having the magnitude of numerical U_{en}^* values close together. The applicant stated that: (a) the location with the highest U_{en}^* value is selected as a sentinel location, (b) the location with the second highest U_{en}^* value will be selected as a sentinel location if that value is greater than 50 percent of the highest value, and (c) the location with the third highest U_{en}^* value will be selected as a sentinel location if that value is within 25 percent of the highest value. The staff finds this response acceptable because: (a) the applicant provided the specific criteria for selecting sentinel locations based on U_{en}^* values, and (b) the selection criteria provides a conservative threshold when selecting additional sentinel locations within a thermal zone and accounts for variances in U_{en}^* values based on refinements and other considerations.

Also in the third part of its response, the applicant stated that it will not use the U_{en}^* of one material to bound a location of a different material within a thermal zone. The staff finds this response acceptable because the applicant’s current methodology will not need to include the additional considerations when comparing U_{en}^* values of different materials. For the reasons stated above, the staff’s concerns in RAI 4.3.3-2a are resolved.

The staff finds that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of reactor water environment on fatigue 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 effects of reactor water environment on fatigue have been adequately addressed and will be managed by the Fatigue Monitoring program. Therefore, the applicant’s EAF 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 FSAR Supplement

LRA Section A.2.2.2 provides the FSAR supplement summarizing the TLAA on the effects of the reactor water environment on fatigue life. The staff reviewed LRA Section A.2.2.2 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 FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA.

In its response to RAI 4.3.3-3, by letter dated December 12, 2016, the applicant amended FSAR Section A.2.2.2 to clarify its use of NUREG/CR-6909. The staff finds this amendment to the FSAR acceptable, as discussed in the staff's evaluation of the applicant's response to RAI 4.3.3-3.

In its response to RAI 4.3.3-2, by letter dated December 12, 2016, the applicant amended FSAR Section A.2.2.2 to state that EPRI Report 1024995 will be used to identify and evaluate plant-specific locations that may be more limiting than those identified in NUREG/CR-6260. However, the staff issued RAI 4.3.3-2a regarding concerns with the applicant's methodology. In its response to RAI 4.3.3-2a, the applicant amended the FSAR supplement to reflect its updated EAF evaluations. This amendment includes: (a) that components in one thermal zone will not be compared to components in different thermal zones, (b) the conservative and appropriate parameters that will be used to calculate the screening F_{en} values, (c) that locations of one material will not be used to bound locations of differing materials, and (d) that the level of refinement will be considered when comparing locations within a thermal zone.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR 4.3.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address EAF, 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 the reactor water environment on fatigue will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the EAF evaluations, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification (EQ) of Electric Equipment

The 10 CFR 50.49 Environmental Qualification (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 controls (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., loss-of-coolant accidents (LOCAs) or high-energy line breaks (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 and shall demonstrate that for each type of EQ equipment, one of the following is true: (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4 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 environment. 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. In accordance with 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 dispositioned the TLAA for the EQ program in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating 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 to meet 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 in 10 CFR 50.49. The staff conducted an aging management program 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 AMR 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. Based on its audit as described in SER Section 3.0.3.1.4, 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 for a TLAA evaluation is consistent with SRP-LR Section 4.4.2.1.3 and SRP-LR Table 4.4-1. Additionally, based on its review of applicable exemptions to TLAAs during the audit, the staff 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 applicant has demonstrated that its 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 FSAR Supplement

LRA Section A.4.4 provides the FSAR 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 FSAR supplement that includes a summary description of the TLAA evaluation of the environmental qualification of electric equipment and has provided a FSAR supplement with information equivalent to that in SRP-LR Table 4.4-2.

Based on its FSAR supplement review, the staff finds it meets the acceptance criteria in SRP-LR Section 4.4.2.2 and therefore is acceptable. Additionally, the staff finds 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 FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

SRP-LR Table 4.1-2 and SRP-LR Section 4.5 state that the CLB may include a concrete containment tendon prestress analysis. The SRP-LR also states that this type of analysis may need to be identified as a TLAA when assessed against the six criteria for defining TLAAs in 10 CFR 54.3(a).

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 states that this TLAA is not applicable because WF3 does not have prestressed tendons in the containment structure, as identified in FSAR Sections 1.8.1.35 and 3.8.

4.5.2 Staff Evaluation

The staff assessed the applicant's statement against the information in the FSAR to assess the validity of the applicant's basis on this TLAA identification topic.

In its review, the staff noted that FSAR Section 3.8 indicates that the containment vessel is made from steel vertical cylinders, hemispherical domes, and flat circular bases. Thus, the FSAR provides sufficient demonstration that the containment vessel is not based on any concrete design containing prestressed tendons and that the CLB for WF3 does not include any concrete containment tendon prestress analysis that, otherwise, might need to be identified as a TLAA.

Based on its review, the staff concludes that the concrete containment tendon prestress analysis addressed in the SRP-LR is not applicable to the design of WF3 because the FSAR provides sufficient demonstration that this type of analysis is not applicable to the CLB.

4.5.3 Updated Safety Analysis Report Supplement

The staff concludes that no USAR supplement is required because the WF3 containment does not have prestressed tendons.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes this TLAA is not required.

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

4.6.1 Summary of Technical Information in the Application

LRA Section 4.6 states that, as identified in FSAR Section 3.8.2.3, the containment vessel was designed to exhibit a general elastic behavior under accident and earthquake conditions, and no fatigue evaluation was performed for the containment vessel design.

LRA Section 4.6 describes the applicant's TLAA for containment penetration bellows, and it states that as described in FSAR Section 3.6.2.4, these bellows are designed for a minimum of 7,000 thermal cycles and 200 design seismic movements or cycles. This section concludes that this number of cycles is more than these expansion joints will experience through the period of extended operation.

The applicant dispositioned the TLAA for the penetration bellows in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analysis remains valid for the period of extended operation.

4.6.2 Staff Evaluation

The staff noted from FSAR Section 3.8.2 that a fatigue evaluation was not performed for the steel containment vessel that was designed in accordance with Article NE-3000 of the 1971 Edition of ASME Code Section III. The staff evaluation for generic TLAAs that are not applicable to the CLB or analyses that do not conform to the definition of a TLAA in 10 CFR 54.3(a) is provided for the containment vessel in SER Section 4.1.

The staff reviewed the applicant's TLAA for the containment penetration 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 states 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. The SRP-LR also states that this comparison needs to confirm that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

A review of the WF3 FSAR Section 3.6.2.4 confirmed that the bellows are designed to withstand a total of 7,000 cycles of expansion and compression due to maximum operating conditions and an additional 200 cycles due to seismic movements. However, on the basis of its review of the FSAR, LRA Section 4.6, and LRA Table 4.3-1, the staff did not have sufficient information to determine which transients were considered in the original design analysis of the penetration bellows. By letter dated November 7, 2016, the staff issued RAI 4.6-1 requesting that the applicant provide information on the number of transient cycles experienced by the penetration bellows to date, and their extrapolation through the period of extended operation that would demonstrate that the TLAA analyses for the penetrations bellows meets the criteria of 10 CFR 54.21(c)(1)(i).

In its response dated December 7, 2016, the applicant stated that design requirements specified that penetration bellows be qualified for 7,000 cycles at "maximum operating conditions" and 200 cycles due to design seismic movements. The applicant also stated that the combination of the "maximum operating conditions" does not occur during normal plant operation and the actual movement that is experienced during normal plant operation is much smaller than movements during accident conditions. The applicant further stated that in determining the "maximum operating conditions," containment growth from post-accident pressurization and from post-accident thermal expansion was included, as well as the deflections caused by piping, guard pipe, and sleeve expansion because of elevated temperature. The applicant also stated that containment leak rate tests have been performed less than 10 times over the life of the plant, RCS heatups are shown in LRA Table 4.3-1 with 70 cycles and with a projected 60-year value of 144 cycles, and that no operating basis earthquake (OBE) events have occurred.

The staff held a conference call with the applicant on January 23, 2017, to seek clarification of the applicant's response to RAI 4.6-1. During the call, the applicant clarified, as described in its response, that the transient cycles considered during normal operation for the penetration bellows are the RCS heatup/cooldown, containment integrated leakage rate test (ILRT), and the OBE.

The staff finds the applicant's response acceptable because: (1) the applicant described the transient cycles associated with penetration bellows for normal operation, and (2) the extrapolation to 60 years of operation of the total number of applicable operating transients experienced by the penetration bellows (i.e., total projected cycles of 174 based on 144 cycles of RCS heatup/cooldown, 10 ILRT cycles, and 1 OBE event with 20 cycles) confirms that penetration bellows design cycle values due to maximum operating conditions and seismic movements will not be exceeded during the period of extended operation. The staff's concern described in RAI 4.6-1 is resolved.

The staff finds that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the penetration bellows remains valid for the period of extended operation. Additionally, it meets the acceptance criteria in SRP-LR Section 4.6.3.1.1.1 because a comparison of the extrapolation to 60 years of operation of the number of operating transients

experienced to date for the penetration bellows and the number of transients in the existing analyses confirms that the number of transients in the existing analyses will not be exceeded during the period of extended operation.

4.6.3 FSAR Supplement

LRA Section A.2.4 provides the FSAR supplement summarizing the evaluation of the containment vessel design and the penetration bellows analysis. The staff reviewed LRA Section A.2.4 consistent with the review procedures in SRP-LR Section 4.6.3.2, which states that the staff verifies that the applicant has provided an FSAR supplement that includes a summary description of the evaluation of the metal fatigue TLAA with information equivalent to that in SRP-LR Table 4.6-1.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.6.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the TLAA for penetration bellows, as required by 10 CFR 54.21(d).

4.6.4 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 metal fatigue analysis for the containment penetration bellows remains valid for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7 <u>Other Plant-Specific Time-Limited Aging Analyses</u>

LRA Section 4.7 summarizes the evaluation of the following plant-specific TLAAs:

- LRA Section 4.7.1, Crane Load Cycle Analysis
- LRA Section 4.7.2, Leak-Before-Break Analysis
- LRA Section 4.7.3, Postulation of High Energy Line Break (HELB) Locations
- LRA Section 4.7.4, Reactor Vessel Internals Evaluations (Other than Fatigue)

4.7.1 Crane Load Cycle Analysis

4.7.1.1 Summary of Technical Information in the Application

LRA Section 4.7.1 describes the applicant’s TLAAs for the polar crane, fuel handling building (FHB) crane, and radwaste cask handling bridge crane. The LRA states that a review of these cranes determined that they were designed in accordance with the Crane Manufacturer's Association of America Specification No. 70 (CMAA-70). The LRA states that cranes designed to CMAA-70 have cycles specified as part of their design analysis and although their analyses do not involve time-limited assumptions defined by the current operating term (e.g., 40 years), crane cycle limits are nevertheless evaluated as TLAAs. The LRA also states that Table 3.3.3.1.3-1 of CMAA-70 associates crane service classes with ranges of loading cycles and labels Service Class A1 cranes as those that have been designed for up to 100,000 loading cycles. The LRA further states that the expected number of applicable load cycles for the WF3 cranes is below the maximum of the lowest cyclic loading range of 100,000 cycles as documented in CMAA-70.

The applicant dispositioned the TLAA for the polar crane, FHB crane, and radwaste cask handling bridge crane in accordance with 10 CFR 54.21(c)(1)(i) by demonstrating that the analyses remain valid for the period of extended operation.

4.7.1.2 Staff Evaluation

The staff reviewed the applicant's TLAAs for the polar crane, FHB crane, and radwaste cask handling bridge cranes, 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, which state that the applicant should show that the existing analyses are valid and bounding for the period of extended operation. Specifically, the SRP-LR states that the applicant should describe the TLAA with respect to the objectives of the analysis and show that conditions and assumptions used in the existing analysis address the relevant aging effects, and that acceptance criteria are maintained to provide reasonable assurance that the intended SSC functions are maintained during the period of extended operation.

To verify that the conditions and assumptions used in the existing analysis address the relevant aging effects and that the analysis remains valid (intended functions of cranes remain) during the period of extended operation, the staff reviewed the referenced Table 3.3.3.1.3-1 of CMAA-70 associated with crane service classes and ranges of loading cycles. The staff noted that although LRA Section 4.7.1, "Crane Load Cycle Analysis" references Table 3.3.3.1.3-1 of CMAA-70 for the design of the listed cranes, it does not include the anticipated number of load cycles (lifts) considered essential for the disposition of the TLAA per 10 CFR 54.21(c)(1)(i) for any of the listed CMAA-70 cranes. LRA Section B.1.17, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems" evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. The staff's evaluation of LRA Section B.1.17, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems" is documented in SER Section 3.0.3.2.12. As described in SER Section 3.0.3.2.12, the applicant provided responses to RAIs B.1.17-01 and B.1.17-02. A completion description of the RAIs and the applicant's responses is provided in SER Section 3.0.3.2.12.

The staff reviewed the applicant's responses to RAIs B.1.17-01 and B.1.17-02 for the listed cranes in LRA Section 4.7.1, and confirmed that the listed safety-related cranes are designed to CMAA-70 specifications, and their loading cycles are consistent with the design requirements through the period of extended operation, as follows:

<u>Polar and FHB Cranes</u>. The staff reviewed the applicant's response to RAI B.1.17-01 describing the limited load cycles of the polar crane main hook, and an increased number of load cycles for its auxiliary hook. The staff noted that the estimated load cycles are consistent with the limited functions of the polar crane but include construction inside the containment as well as service during refueling outages, as described in FSAR Section 3.8.3.1.5, "Steel Internal Structures." FSAR Sections 4.3.1.2, "Core Design Lifetime and Fuel Replacement Program," and 12.3.1.4, "Fuel Transfer Shield," detail the crane load cycles potentially associated with each refueling (i.e., every 18 months 40 percent or more (up to a maximum of 358) of fuel assemblies are replaced). Similarly, the primary functions of the cask crane (main and auxiliary hooks) are to place the new fuel into the new fuel storage racks, transfer the new fuel to the new fuel elevator, and move the empty or loaded spent fuel transfer casks between the cask storage areas. A review of FSAR Section 9.1.4.1.3, "Containment Polar Crane and Cask Crane," reaffirms that both the polar and cask cranes with main and auxiliary hooks are CMAA-70 cranes consistent with NUREG-0612.

The staff noted that both the polar and FHB cranes have auxiliary hooks in addition to the main hook, with different lift capacities and structural members common to both the main and auxiliary hooks. Shared components for both main and auxiliary hooks experience different loads and loading cycles. Therefore, their combined contribution for a potential fatigue failure needs to be considered. To correlate crane lift capacities and load cycles for any potential fatigue issues arising from common use of structural members from main and auxiliary hooks, the staff reviewed FSAR Section 9.1.4.1.3, "Containment Polar Crane and Cask Crane," for crane hook capacities. In accordance with the FSAR, the main hook capacity of the polar crane is 200 tons, while its auxiliary hook is rated at 15 tons. For the polar crane, the combined (total) number of reported load cycles for the main and auxiliary hooks (i.e., 850 load cycles for the main hook and 84,500 for the auxiliary), irrespective of their lift capacities, remains less than the maximum of the lowest cyclic loading range in CMAA-70 of 100,000 cycles for service classification A1. Hence, their combined contribution for a potential fatigue failure of structural shared components needs no further analysis.

The staff finds that the analysis for the polar crane remains valid during the period of extended operation because: (1) the applicant follows the guidance in NUREG-0612 for safety-related cranes, which includes a tally of anticipated number of loading cycles and conformance to CMAA-70 design specifications; and (2) the total estimated number of loading cycles for the main and auxiliary hook is less than the 100,000 permissible cycles for a CMAA-70 Class A1 crane.

The FHB crane (main hoist and trolley), although a single-failure-proof crane and compliant to the requirements of ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," is still classified per ASME NOG-1, Section 4350, "Fatigue Requirements," as a CMAA-70 crane when the loading cycles exceed 20,000. Its main hook capacity is 125 tons, while each of the auxiliary hooks is rated at 15 tons. FSAR Sections 9.1.2.2, "Facilities Description," 9.1.1.3, "Safety Evaluation," and 15.7.3.5.1, "Cask Drop Into Spent Fuel Pool, Cask Pit Storage Area, Cask Decontamination Area, and Rail Bay," state the usage of the auxiliary hoists is to handle poison and fuel assemblies plus handling tools; whereas the single-failure-proof main hook is the only hook permitted to carry a spent fuel transfer cask or other heavy load over the cask storage area or any unprotected safety-related equipment. The staff finds that structural components exclusive to the main hook (with projected 875 lifts) and auxiliary hooks (with projected 50,000 and 75,000 lifts, respectively) of the FHB crane meet the design specifications of CMAA-70 for Class A1 cranes.

The staff noted, however, in evaluating the TLAA for shared structural components of the main and auxiliary hooks of the FHB crane, that the combined contribution of their load lifting capacities and loading cycles needs to be considered. The auxiliary hook loads however are minimal as noted in FSAR Section 9.1.2.2, which states that "[t]he auxiliary hoists of the cask crane will only be used to handle the poison assemblies of less than 200 pounds (including the weight of the tool) during the surveillance test." The contribution of such light loads to the overall fatigue loading of the FHB crane constructed with ASTM A36 steel structural steel components (see FSAR Section 3.8) consistent with CMAA-70 specifications, is negligible. Hence, the analysis of shared crane structural components remains valid through the period of extended operation.

The staff finds that the FHB crane analysis remains valid during the period of extended operation because: (1) the applicant follows the guidance in NUREG-0612 for safety-related cranes, which includes an estimated number of loading cycles and conformance to CMAA-70 design specifications; and (2) based on the projected number of load cycles and FSAR-stated

crane capacities there is no anticipated fatigue damage or failure to the structural members of the FHB crane.

Radwaste Cask Handling Bridge Crane. The staff reviewed the applicant's response to RAI B.1.17-02 that describes the load cycles for the radwaste cask handling bridge crane through the end of the period of extended operation to be 62,400. The staff also reviewed FSAR Table 3.2-1, "Classification of Structures, Systems and Components," and FSAR Section 9.1.4.2.2.16, "Control of Heavy Loads Requirements," to confirm that the crane is a CMAA-70 Class A crane and the declared load cycles are consistent with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" (ADAMS Accession No. ML070250180) and therefore, are acceptable.

The referenced FSAR Table 3.2-1 identifies the radwaste cask handling bridge crane as a seismic Category I bridge crane (safety-related) built to handle casks for radioactive waste. FSAR Section 9.1.4.2.2.16 states that WF3 implements the guidance of NUREG-0612 to ensure that load handling systems are designed and operated such that their probability of failure is low. The staff notes that NUREG-0612 also includes guidance for lifts of spent fuel casks, as well as for radioactive waste and debris shipping casks. NUREG-0612 states that "crane[s] should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' and of CMAA-70, 'Specifications for Electric Overhead Travelling Cranes.'" The guidance provided by NUREG-0612, Section 4, "Review of Historical Data on Crane Operations," states that an exact accounting of the number of lifts made by each crane was not available and estimates of the frequency of their usage vary greatly, possibly approaching 1,250 lifts per year. The implementation of NUREG-0612 at WF3 is also reflected in LRA Section B.1.17, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

The staff finds that the analysis for the radwaste cask handling bridge crane remains valid during the period of extended operation because: (1) the applicant follows the guidance in NUREG-0612 for the safety-related cranes, which includes an estimated number of loading cycles and conformance to CMAA-70 design specifications; and (2) the projected number of 62,400 loading cycles is less than the 100,000 permissible cycles for a CMAA-70 Class A1 crane.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analysis for the polar crane, FHB crane, and radwaste cask handling bridge 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 has demonstrated that the polar crane, FHB crane, and radwaste cask handling bridge crane load cycle analyses remain within the bounds of CMAA-70 allowable load cycles and therefore are valid through the period of extended operation.

4.7.1.3 FSAR Supplement

LRA Section A.2.5.1 provides the FSAR supplement summarizing the crane load cycle limits for the polar crane, FHB crane, and radwaste cask handling bridge crane, as amended by letter dated January 16, 2017. The staff reviewed amended LRA Section A.2.5.1 consistent with the review procedures in SRP-LR Section 4.7.3.2, which states that the applicant has to provide information to be included in the FSAR supplement that includes a summary description of the evaluation of each TLAA. SRP-LR Section 4.7.3.2 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 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 FSAR supplement, as amended by letter dated January 16, 2017, through RAI B.1.17-02, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.3.2 and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the analysis of crane load cycle limits for the polar, FHB, and radwaste cask handling bridge cranes, 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 crane load cycle analyses for the polar crane, FHB crane, and radwaste cask handling bridge crane remain valid for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2 Leak-Before-Break Analysis

Leak-before-break (LBB) analyses were approved for the main coolant loop and pressurizer surge line as part of the CLB for WF3. Topical report CEN-367, “Leak-Before-Break Evaluation of Primary Coolant Loop Piping in Combustion Engineering Designed Nuclear Steam Supply Systems,” was approved in an SE dated October 30, 1990, for application of the LBB analysis to the WF3 main coolant loop. By letter dated February 22, 2010, WF3 submitted a LAR (ADAMS Accession No. ML100550606) to allow implementation of LBB on the pressurizer surge line based on the analysis in WCAP-17187, Revision 0, “Technical Justification for Eliminating Pressurizer Surge Line Rupture as the Structural Design Basis for Waterford Steam Electric Station, Unit 3, Using Leak-Before-Break Methodology,” (WCAP-17187-NP (non-proprietary) is available with ADAMS Accession No. ML100550607). The staff approved implementation of LBB on the pressurizer surge line as part of the CLB at WF3 by SE dated February 8, 2011 (ADAMS Accession No. ML110400149).

4.7.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2 describes the applicant’s TLAA for LBB analysis as it applies to the main coolant loops and pressurizer surge line. The applicant stated that an LBB analysis was used to eliminate dynamic effects, including double-ended guillotine breaks and equivalent longitudinal breaks from the structural design basis. The applicant further stated that the premise of the LBB methodology is that the materials used in nuclear power plant piping are sufficiently tough that even a large through-wall crack would remain stable and would not result in a double-ended pipe rupture.

The applicant’s analysis considers thermal aging of the cast austenitic stainless steel (CASS) pressurizer surge line piping. The applicant stated that the fracture toughness for the CASS is assumed to be saturated (fully aged)and not time-dependent, and therefore is not a TLAA.

The applicant’s analysis also considers pressurizer surge line and main coolant loop fatigue transients that drive flaw growth during plant operation. The applicant determined that fatigue crack growth analysis is time dependent and is a TLAA. The applicant dispositioned the TLAA for the main coolant loops and the pressurizer surge line piping in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of fatigue crack growth on the intended

functions will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

4.7.2.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the main coolant loop and pressurizer surge line 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, which states that the applicant proposes to manage the aging effects associated with the TLAA by an AMP that is reviewed to verify that the effects of aging on the intended functions are adequately managed consistent with the CLB for the period of extended operation. The staff also reviewed the applicant's TLAA against the recommended criteria in SRP-SLR Section 4.3.2.1.1.3, which states that an AMP corresponding to GALL Report AMP X.M1, "Fatigue Monitoring," may be used to demonstrate acceptance of an analysis that is based on transient cycle limits in accordance with the requirement in 10 CFR 54.21(c)(1)(iii). In addition, the staff reviewed the effects of thermal embrittlement of CASS and fatigue crack growth.

Thermal Embrittlement of CASS. The staff confirmed that the LBB analyses included an assessment of thermal aging embrittlement of the pressurizer surge line (the main coolant loop does not contain CASS components). The staff also confirmed that the analysis of the CASS CF8 materials used to fabricate the pressurizer surge line assumed fully aged, lower bound fracture toughness properties, as based on fracture toughness data compiled by Argonne National Laboratories in NUREG/CR-6177, "Assessment of Thermal Embrittlement of Cast Stainless Steels," and in NUREG/CR-4513, "Estimation of Fracture Toughness of Cast Stainless Steels during Thermal Aging in LWR Systems." The Argonne National Laboratories data support that the current 40-year assessment of the fracture toughness property for CASS CF8 materials is appropriately assumed at the lower bound (fully aged) value, and therefore, the fracture toughness for CASS CF8 would not change for a 60-year assessment. Based on its review, the staff concludes that the treatment and analysis of thermal aging embrittlement in CASS portions of the pressurizer surge line is not a TLAA because it is not based on a time-dependent parameter defined by the current operating term and therefore does not conform to Criterion 3 in 10 CFR 54.3(a).

Fatigue Crack Growth. The staff noted that the applicant is dispositioning the fatigue flaw growth TLAA of the LBB analyses using the criterion in 10 CFR 54.21(c)(1)(iii) and will be using the Fatigue Monitoring program as the basis for managing the effects of fatigue crack growth on the intended functions of the main coolant loops and pressurizer surge line during the period of extended operation.

The staff noted that LRA Section 4.3.1 states that the Fatigue Monitoring program will monitor the necessary operating transients and assure action is taken before the analyzed numbers of transients being exceeded. However, LRA Section 4.7.2 did not clarify which transients will be monitored for this TLAA. By letter dated October 12, 2016, the staff issued RAI 4.3.1-2, requesting the applicant to identify which transients were used in the analysis and to confirm that these transients will be monitored under the Fatigue Monitoring program.

In its response dated December 12, 2016, the applicant stated that the monitored transients include RCS heatups and cooldowns, reactor trip, loss of load, loss of reactor coolant flow, pressurizer heatups and cooldowns, and OBEs. The applicant provided the below justification for transients that are not tracked; the staff's evaluations follow:

- Pressurizer insurge and outsurge transient cycles are based on the cycle count of pressurizer heatups and cooldowns. The staff agrees that full insurges and outsurges are accounted for by tracking pressurizer heatups and cooldowns.
- Thermal stratification transients in the pressurizer surge line are also based on the cycle count of pressurizer heatups and cooldowns. The staff agrees that thermal stratification cycles are accounted for by tracking the pressurizer heatup and cooldown cycles.
- Leak test transients are not tracked because the testing does not add additional stress beyond that of RCS heatups. The staff agrees that leak test transients are accounted for by tracking RCS heatups.
- Hydrostatic tests are not performed at WF3. The staff understands that tracking hydrostatic test transients is not necessary because these tests are not conducted at the facility.
- Loss of secondary pressure is a Level C (emergency) transient that is excluded from the fatigue analysis per ASME Code Section III, subparagraph NB-3224-5.

The applicant also confirmed that the Fatigue Monitoring program will track the monitored transients. The staff finds the applicant’s response partially acceptable because the applicant stated which transients are monitored and provided appropriate justification for all but one of the transients that are not monitored; and the applicant stated that the loss of secondary pressure transient is not monitored per ASME Code Section III, subparagraph NB-3224-5.

The staff noted that ASME Code Section III, subparagraph NB-3224-5, applies only to the monitoring of design basis transients that are inputs to cumulative fatigue analyses that are required by ASME Code Section III, and does not apply to the monitoring of cycles for design basis transients that are inputs to time-dependent LBB flaw growth calculations. The staff also noted that the loss of secondary pressure transient is required to be monitored by TRM Section 5.7, Table 5.7-1, “Component Cyclic or Transient Limits,” as invoked by TS Section 6.5.5, “Component Cyclic or Transient Limit.” By letter dated February 14, 2017, the staff issued RAI 4.3.1.2-a requesting the applicant to clarify and justify the exclusion from monitoring of the loss of secondary pressure transient.

In its response dated March 16, 2017, the applicant stated that the LRA will be revised to add the loss of secondary pressure transient to transients tracked by the Fatigue Monitoring program, listed in LRA Table 4.3-1. The staff finds the applicant’s response acceptable because the loss of secondary pressure transient will now be tracked by the Fatigue Monitoring program consistent with the aforementioned TRM and TS sections. The staff’s concerns described in RAIs 4.3.1-2 and 4.3.1.2-a are resolved.

The staff noted that as long as the number of transients that occur at the site remain bounded by the 40-year number of cycles assumed in these analyses, the LBB evaluation remains valid. The staff determined that the Fatigue Monitoring program ensures that the number of transients will not be exceeded during the period of extended operation or that corrective actions are taken as these cycle limits are approached. Therefore, the staff finds the applicant’s proposal to credit the Fatigue Monitoring program to manage the LBB analyses through the period of extended operation acceptable. The staff’s evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7.

The staff finds the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of fatigue crack growth on the intended functions of the main coolant loop and

pressurizer surge line will be adequately managed for the period of extended operation. Additionally, the TLAA meets the acceptance criteria in SRP-LR Sections 4.7.3.1 and 4.3.2.1.1.3 because the Fatigue Monitoring program monitors and tracks the transient cycles assumed in the analyses and requires corrective action prior to exceeding the number of transient cycles used in the analyses.

4.7.2.3 FSAR Supplement

LRA Section A.2.5.2 provides the FSAR supplement summarizing the LBB TLAA that eliminates the dynamic effects of double-ended guillotine breaks and equivalent longitudinal breaks from the structural design bases. The staff reviewed LRA Section A.2.5.2 consistent with the review procedures in SRP-LR Section 4.7.3.2, which states that the reviewer verifies that the FSAR supplement includes a summary description of the TLAA evaluation and that it includes information that the TLAA has been dispositioned for the period of extended operation.

The staff noted that the applicant's FSAR supplement summary description for the LBB TLAA provides an accurate and sufficient discussion of the LBB TLAA consistent with the LBB design basis in FSAR Section 3.6.3. The staff also noted that the LBB TLAA summary description states that the Fatigue Monitoring program will be used during the period of extended operation to manage the fatigue-related effects of aging that are applicable to the components within the scope of the LBB TLAA. The staff reviewed descriptions of the transients included in the analysis and tracked by the Fatigue Monitoring program and found them acceptable. The applicant has provided an adequate description of the TLAA consistent with the basis for accepting the TLAA in accordance with 10 CFR 54.21(c)(1)(iii).

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.3.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the fatigue crack growth analyses for the pressurizer surge line and main coolant loop piping in scope of the LBB TLAA, 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)(iii), that the effects of fatigue crack growth on the LBB analyses of the main coolant loop and pressurizer surge line will be adequately managed by the Fatigue Monitoring program for the period of extended operation. In addition, the applicant has demonstrated that the LBB analyses of the main coolant loop piping and pressurizer surge line piping will continue to meet design basis criteria in 10 CFR Part 50, Appendix A, General Design Criterion 4, "Dynamic Effects," during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.3 Postulation of High-Energy Line Break (HELB) Locations

4.7.3.1 Summary of Technical Information in the Application

LRA Section 4.7.3 states that rupture locations in ASME Code Section III, Class 1 piping (excluding the RCS loop and surge piping) have been postulated in any piping run or branch at terminal ends and other intermediate points. The LRA states that these HELB location postulations were done in accordance with RG 1.46, "Protection Against Pipe Whip Inside

Containment," and BTP MEB-1, which was issued with Generic Letter 87-11, "Relaxation in Arbitrary Intermediate Pipe Rupture Requirements." The LRA states that the postulated rupture locations for Class 1 piping are as follows:

(1) Terminal points.

(2) Any intermediate points between terminal ends where the cumulative usage factor (CUF) exceeds 0.1 (based upon normal and upset plant conditions and operating basis earthquake [OBE]).

(3) Any intermediate points between terminal ends where the primary plus secondary stress intensities (S_m) derived on an elastic basis is greater than 2.0 S_m in ferritic and 2.4 S_m in austenitic piping materials (based on normal and upset plant conditions and OBE).

The LRA states that fatigue analyses were performed to determine CUF values for the intermediate points, and the applicant considered these fatigue analyses as TLAAs. The LRA also states that the Fatigue Monitoring program will be used to track and monitor the transients that affect high-energy piping systems and the applicant will perform corrective actions as the transients approach the analyzed number of cycles. Therefore, the applicant dispositioned the TLAA for the CUF calculations used to determine HELB postulated break locations in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.3.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the postulation of HELB locations and the corresponding disposition of 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR 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 IPA in 10 CFR 54.21(a)(3). The SRP-LR also states that the staff 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. The staff also reviewed the applicant's TLAA against the recommended criteria in SRP-SLR Section 4.3.2.1.1.3, which states that an AMP corresponding to GALL Report AMP X.M1, "Fatigue Monitoring," may be used to demonstrate acceptance of a CUF-based analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii).

FSAR Section 3.6.1.2 states that high-energy systems include piping systems that exceed 200 °F and/or 275 psig during normal operating conditions. As stated in LRA Section 4.7.3 and FSAR Section 3.6.2.1.1.2, any postulated intermediate points between terminal ends where the CUF exceeds 0.1 have been postulated as rupture locations in these high-energy systems. The LRA further states that the fatigue analyses used to determine the CUF values of these intermediate points are considered TLAAs. The staff noted that the postulation of break location based on CUFs is a TLAA because it is dependent on an assumed number of cycles expected for the design of the plant. The applicant credits the Fatigue Monitoring program to track and monitor the transients that affect high-energy piping systems. However, the staff noted that the applicant did not identify which transients affect high-energy systems and that are used as inputs into the fatigue analyses. The staff required clarification if these transients are within the scope of the Fatigue Monitoring program such that they will be monitored and tracked throughout the period of extended operation. By letter dated October 12, 2016, the staff issued RAI 4.3.1-2, requesting the applicant to clarify if the transients used in the determination of postulated HELB locations will be monitored and tracked by the Fatigue Monitoring program throughout the period of extended operation.

In its response, by letter dated December 12, 2016, the applicant stated that the fatigue analyses used in the HELB evaluations were included in the fatigue analyses that were performed in the fatigue evaluations in the design of the WF3 Class 1 components, which will be managed by the Fatigue Monitoring program. LRA Section 4.3.1 discusses the Class 1 fatigue TLAAs, and the staff's review of these analyses is documented in SER Section 4.3.1. The staff finds the applicant's response acceptable because the applicant confirmed that the transient inputs for the determination of HELB locations are included within the scope of the Fatigue Monitoring program and will be monitored and tracked throughout the period of extended operation. The staff's concerns in RAI 4.3.1-2 are resolved.

The staff noted that as long as the number of transients that occur at the site remain bounded by the 40-year number of cycles assumed in these analyses, the HELB postulation evaluation remains valid. The staff determined that the Fatigue Monitoring program ensures that the number of transients will not be exceeded during the period of extended operation or that corrective actions are taken as these cycle limits are approached. Therefore, the staff finds the applicant's proposal to credit the Fatigue Monitoring program to manage the HELB analyses through the period of extended operation acceptable. The staff's evaluation of the Fatigue Monitoring program is documented in SER Section 3.0.3.2.7.

The staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the fatigue analyses used to determine the CUF values of HELB locations will be adequately managed by the Fatigue Monitoring program for the period of extended operation.

Additionally, the applicant's TLAA disposition meets the acceptance criteria in SRP-LR Sections 4.7.2.1 and 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 prior to exceeding the number of transient cycles used in the analysis.

4.7.3.3 FSAR Supplement

LRA Section A.2.5.3 provides the FSAR supplement summarizing the applicant's TLAA for the postulation of HELB locations. The staff reviewed LRA Section A.2.5.3 consistent with the review procedures in LRA Section 4.7.3.2, which state that the information to be included in the FSAR supplement should include a summary description of the TLAA evaluation.

Based on its review of the FSAR supplement, the staff finds that it meets the acceptance criteria in SRP-LR Section 4.7.3.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the applicant's TLAA for the postulation of HELB locations, as required by 10 CFR 54.21(d).

4.7.3.4 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)(iii), that the fatigue analyses used to determine the CUF values of HELB locations will be adequately managed by the Fatigue Monitoring program for the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.4 Reactor Vessel Internals Evaluations (Other than Fatigue)

4.7.4.1 Summary of Technical Information in the Application

LRA Section 4.7.4 describes the applicant's TLAA for RVI evaluations (other than fatigue). The applicant stated that the materials used to fabricate the RVI and core support components are exposed to a high-temperature aqueous environment, fast neutron irradiation, and applied loads. The applicant stated that it performed an evaluation of these components to assess the effect of the extended power uprate (EPU) conditions on the potential for degradation of the RVI component materials. The applicant stated that the evaluation addressed age-related degradation mechanisms of materials that could be affected by the reactor coolant temperature and by cumulative exposures to neutron and gamma irradiation. The applicant also stated that the evaluations demonstrated that the neutron and gamma flux exposures to the components under uprated, 40-year power conditions, are lower than considered for the components in the original design. Therefore, the level of irradiation-induced embrittlement was not expected to change significantly with the uprate. The applicant also stated that loss of fracture toughness of CASS components as a result of thermal aging and neutron irradiation was not significantly affected by the power uprate request.

The applicant stated, however, that the aging evaluations of the RVI components assessed in the 2005 EPU LAR are considered TLAAs because they were based on operation only until the end of the original 40-year operating term. In addition, the applicant stated that, in the EPRI MRP's development of the augmented inspection program in MRP-227-A for CE-designed RVI components, the MRP authors considered degradation mechanisms associated with irradiation of the components since initial plant operations. The applicant also stated that the inspection and evaluation guidelines of MRP-227-A are designed to manage the effects of aging of RVI, and that the WF3 Reactor Vessel Internals program incorporates the guidance in MRP-227-A for CE-designed PWRs.

The applicant dispositioned the TLAA for the RVI evaluations in accordance with 10 CFR 54.21(c)(1)(iii) by demonstrating that the effects of aging on the intended functions will be adequately managed by the Reactor Vessel Internals program (LRA AMP B.1.33) during the period of extended operation.

4.7.4.2 Staff Evaluation

The staff reviewed the applicant's TLAA for the RVI evaluations and the corresponding disposition of the TLAA in accordance with 10 CFR 54.21(c)(1)(iii), consistent with the review procedures in SRP-LR Section 4.7.3.1.3, which states that the staff reviews the applicant's AMP to verify that the effects of aging on the intended function(s) will be adequately managed consistent with the CLB during the period of extended operation.

EPRI TR No. 1013234 (MRP-191, ADAMS Accession No. ML091910130) provides EPRI's technical evaluation to support the RVI inspection program for CE-designed RVI components in EPRI TR No. 1022863 (MRP-227-A), and it provides an updated aging analysis for CE-designed RVI components through 60 years of licensed operations. The staff observed that the basis for using the Reactor Vessel Internals program to accept this TLAA under the criterion in 10 CFR 54.21(c)(1)(iii) is acceptable as long as the projected neutron fluence for the RVI components in the vicinity of the reactor core (i.e., those located in the core shroud) through 60 years of operation remains bounded by the fluence estimates for these components in the MRP-191 report.

The staff reviewed the previous evaluation of RVI components in the SE for the EPU for relevancy to this TLAA. The staff noted that the applicant submitted the LAR for the EPU on November 3, 2003, and that the license amendment was approved in an SE, dated April 15, 2005 (ADAMS Accession No. ML051030068). The SE identifies that the applicable aging effects for the TLAA are loss of fracture toughness due to neutron irradiation embrittlement and cracking induced by an irradiation-assisted stress corrosion cracking (IASCC) mechanism. Section 2.1.4 of the SE identifies that the projected neutron fluences for RVI components in the vicinity of the reactor core will range from 3.0-5.0 x 10^{22} n/cm^2 (E > 0.1 MeV) through 40 years of licensed operations.

In TR MRP-191, EPRI estimates that RVI components in the core shroud of CE-designed plants will generally have neutron fluences ranging from 1.0-5.0 x 10^{22} n/cm^2 through 60 years of licensed operations. Based on a comparison of information in the relevant documents, the staff observed that the projected neutron fluences for RVI core shroud components at WF3 through 40 years of operation could be already near or at the limits cited for these components in the MRP-191 report. The staff noted that this could imply that the RVI components in the vicinity of the reactor core at WF3 are being irradiated faster than what MRP-191 has estimated for these components over a 60-year operating term.

Therefore, the staff determined that it would need additional demonstration that the neutron fluence values projected for these types of RVI components through 60 years of licensed operation will remain within the fluence estimates for the components in Table 4-7 of the MRP-191 report. By letter dated November 7, 2016 (ADAMS Accession No. ML16307A007), the staff issued RAI 4.7.4-1, requesting that the applicant provide additional technical justification that the projected neutron fluences for RVI core shroud components through 60 years of licensed operation are still considered to be bounded by the fluence estimates for these components in Table 4-7 of the MRP-191 report. Otherwise, the staff requested that the applicant clarify what the impact will be on the failure modes, effects, and criticality analysis (FMECA) assessment for these components and the inspection plan for RVI components if it is determined that the 60-year neutron fluence value for any RVI core shroud component will exceed the neutron fluence estimate for the component in Table 4-7 of the MRP-191 report.

In its response dated February 6, 2017, the applicant stated that the fluence values for RVI components in EPRI Report MRP-191 are estimates. The applicant also stated that the estimates are not bounding values above which the MRP-191 evaluations would be invalid. The applicant referenced MRP-2013-025, “MRP-227-A Applicability Template Guideline,” which establishes a range of conditions for which the MRP-227-A inspection and evaluation guidelines are applicable. For a CE-designed reactor, MRP-2013-025 identified that the neutron fluence and heat generation rates are acceptable for applicability of the inspection and evaluation guidance of MRP-227-A if reactor parameters meet the following thresholds:

- active fuel to fuel alignment plate (FAP) distance > 12.4 inches
- average core power density < 110 Watts/cm^3
- heat generation figure of merit, F ≤ 68 Watts/cm^3

The applicant also stated that the guidelines in MRP-2013-025 were established to ensure that plant-specific fluence levels remained within acceptable values to ensure continuing applicability of MRP-227-A. In addition, the applicant stated that there is no impact on the inspection plan for RVI components if the 60-year neutron fluence value for any RVI core shroud component exceeds the neutron fluence estimate for the component in the MRP-191 report.

The staff reviewed MRP-2013-025, which states that MRP-227-A I&E Guidelines should remain applicable as long as the average core power and peripheral heat generation limits imposed remain bounding. It also states that the utility response with regard to the applicability for the uprated condition should consist of appropriate text to identify the uprated plant condition and should include responses to Questions 1 and 2.

> Question 1: Does the plant have any non-welded or bolted austenitic stainless steel (SS) components with 20 percent cold work or greater, and, if so, do the affected components have operating stresses greater than 30 ksi? (If both conditions are true, additional components may need to be screened in for stress corrosion cracking, SCC.)
>
> Question 2: Does the plant have atypical fuel design or fuel management that could render the assumptions of MRP-227-A, regarding core loading/core design, non-representative for that plant?

The applicant provided responses to these questions as well as its plant-specific values for the average core power density, heat generation rate figure of merit, and FAP distance in PWROG-15039-P, “Waterford Unit 3 Summary Report for the Fuel Design/Fuel Management Assessments to Demonstrate MRP-227-A Applicability.” The staff noted that the values were determined based on the EPU, which was approved in the SE dated April 15, 2005 (ADAMS Accession No. ML051030068). The staff also determined that the applicant’s plant-specific values comply with the values in MRP-2013-025. In addition, the staff reviewed WCAP-17780-P, “Reactor Internals Aging Management MRP-227-A Applicability for Combustion Engineering and Westinghouse Pressurized Water Reactor Designs,” which also confirms the applicability requirements of MRP-2013-025. Therefore the staff finds the applicant’s response acceptable because the applicant has provided sufficient demonstration that the design of the RVI components are bounded by the design assumptions in MRP-227-A and the fluence assumptions in MRP-2013-025. The concern described in RAI 4.7.4-1 is resolved.

Based on it review, the staff finds the applicant has demonstrated pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of cracking due to IASCC and loss of fracture toughness due to thermal aging and neutron irradiation embrittlement on the intended functions of the RVI components will be adequately managed by the Reactor Vessel Internals program during the period of extended operation.

4.7.4.3 FSAR Supplement

LRA Section A.2.5.4, “Reactor Vessel Internals Evaluation (Other than Fatigue),” provides the FSAR supplement summarizing the TLAA for the RVI evaluations.

SRP-SLR Section 4.7.2.2 provides the acceptance criteria for FSAR supplement summary descriptions of plant-specific TLAAs, including the one provided in LRA Section A.2.5.4. SRP-LR Section 4.7.2.2 states that the description should contain sufficient information associated with the TLAAs and the basis for demonstrating acceptance of the TLAAs in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

The staff reviewed LRA Section A.2.5.4 consistent with the review procedures in SRP-LR Section 4.7.3.2. This SRP-LR section states that the reviewer should verify that the applicant has provided information in the FSAR supplement that includes a summary description of the

evaluation of each TLAA, and the basis for demonstrating acceptance of TLAA in accordance with one of three acceptance standards for dispositioning TLAAs in 10 CFR 54.21(c)(1)(i), (ii), or (iii).

The staff confirmed that LRA Section A.2.5.4 provides an acceptable summary description of the EPU evaluations of the RVI components, which were considered to qualify as TLAAs for the LRA. The staff noted that the FSAR supplement summary description also indicates that implementation of the applicant's Reactor Vessel Internals program (LRA AMP B.1.33) will serve as the basis for: (1) demonstrating acceptability of this TLAA in accordance with 10 CFR 54.21(c)(1)(iii) and (2) managing the effects of aging on the intended functions of the RVI components during the period of extended operation. The staff confirmed that the applicant has included LRA AMP B.1.33, Reactor Vessel Internals program, in the scope of LRA Appendix B. The staff also confirmed that the program was established to conform to condition monitoring program guidelines for PWR RVI components in GALL Report AMP XI.M16A, "PWR Vessel Internals," and to satisfy a commitment that the applicant made to the staff for the approval of the EPU for the facility. Thus, the regulatory commitment placed on approval of the EPU is closed because: (a) the applicant has included the AMP in the LRA, and (b) the program is based on the collective guidelines of GALL Report AMP XI.M16A and ERPI TR MRP-227-A.

In addition, the applicant has initiated a new commitment (Commitment No. 27) in LRA Table A.4 to implement the Reactor Vessel Internals program before June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later. The staff finds this acceptable because it is consistent with the EPRI MRP's implementation statements made in MRP-227-A.

Based on its review of the FSAR supplement, the staff finds it meets the acceptance criteria in SRP-LR Section 4.7.2.2, and is therefore acceptable. Additionally, the staff finds that the applicant provided an adequate summary description of its actions to address the TLAA for the RVI evaluations, as required by 10 CFR 54.21(d).

4.7.4.4 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 cracking due to IASCC and loss of fracture toughness due to thermal aging and neutron irradiation embrittlement on the intended functions of the RVI components will be adequately managed by the Reactor Vessel Internals program during the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 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: (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 FSAR 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 a renewed license 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 Waterford Steam Electric Station Unit 3 (WF3). The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) will present its safety evaluation report (SER) to the ACRS Subcommittee on Plant License Renewal in a public meeting on September 20, 2018. The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report (SER) is issued. Entergy Operations, Inc. (Entergy or the applicant), and the staff will meet with the full committee to discuss issues, if any, associated with the review of the LRA.

After the staff issues its final SER and the ACRS completes its LRA and SER review, 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 Waterford Steam Electric Station Unit 3 (WF3) 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 LRA review, 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 Waterford Steam Electric Station, Unit 3 (WF3).”

APPENDIX A

LICENSE RENEWAL COMMITMENTS

A. License Renewal Commitments

During the license renewal application (LRA) review of the Waterford Steam Electric Station Unit 3 (WF3) by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff), Entergy Operations, Inc. (Entergy 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 June 30, 2018, along with the implementation schedules and sources for each commitment. The period of extended operation starts on December 18, 2024, for WF3.

Table A.1-1 Waterford Steam Electric Station Unit 3 (WF3) License Renewal Commitments

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
1	Bolting Integrity	Enhance the Bolting Integrity Program as follows: a. Revise Bolting Integrity Program procedures to include submerged pressure retaining bolting b. Revise Bolting Integrity Program Inspected procedures to monitor high strength bolting locations (i.e., bolting with actual yield strength greater than or equal to 150 ksi) for cracking c. Revise Bolting Integrity Program procedures to include a volumetric examination per ASME Code Section XI, Table IWB-2500-1, for high strength closure bolting with actual yield strength greater than or equal to 150 ksi regardless of code classification d. Revise Bolting Integrity Program documents to specify opportunistic inspections of normally submerged dry cooling tower area sump pump discharge piping bolting e. Revise Bolting Integrity Program documents to specify visual inspection of a representative sample of closure bolting (bolt heads, nuts, and threads) from components with an internal environment of a clear gas, such as air or nitrogen. A representative sample will be 20 percent of the population (for each material/environment combination) up to a maximum of 25 fasteners during each 10-year period of the period of extended operation. The inspections will be performed when the bolting is removed to the extent that the bolting threads and bolt heads are accessible for inspections that cannot be performed during visual inspection with the threaded fastener installed.	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2016-0063 October 13, 2016 (ML16287A675) W3F1-2017-0026 April 11, 2017 (ML17102A856)
2	Buried and Underground Piping and Tanks Inspection	Implement the Buried and Underground Piping and Tanks Inspection Program as described in LRA Section B.1.3.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2016-0063 October 13, 2016 (ML16287A675)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
3	Coating Integrity	Implement the Coating Integrity Program as described in LRA Section B.1.4.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2016-0063 October 13, 2016 (ML16287A675) W3F1-2016-0074 December 7, 2016 (ML16342C485)
4	Compressed Air Monitoring	Enhance the Compressed Air Monitoring Program as follows: a. Revise Compressed Air Monitoring Program procedures to include the EDG starting air system b. Revise Compressed Air Monitoring Program procedures to apply consideration of the guidance of ASME OM-S/G-1998 (Part 17), EPRI NP-7079, and EPRI TR-108147 to the limits specified for the air system contaminants c. Revise Compressed Air Monitoring Program procedures to include periodic and opportunistic visual inspections of accessible internal surfaces of system components, including accumulators, flex hoses, and tubing. Specify inspections at frequencies recommended in ASME OM-S/G-1998 (Part 17)	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
5	Containment Inservice Inspection–IWE	Enhance the CII-IWE Program as follows: a. Revise plant procedures to include the preventive actions for storage of ASTM A325, ASTM F1852, and ASTM A490 bolting from Section 2 of Research Council on Structural Connections publication “Specification for Structural Joints Using ASTM A325 or A490 Bolts”	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
6	Diesel Fuel Monitoring	Enhance the Diesel Fuel Monitoring Program as follows: a. Revise the Diesel Fuel Monitoring Program procedures to include the auxiliary diesel generator fuel oil tank and the emergency diesel generator (EDG) fuel oil feed tanks b. Revise Diesel Fuel Monitoring Program procedures to monitor and trend water content, sediment, particulates, and microbiological activity in the fuel oil tanks within the scope of the program at least quarterly c. Revise Diesel Fuel Monitoring Program procedures to include periodic multi-level sampling of tanks within the scope of the program. Include provisions to obtain a representative sample from the lowest point in the tank if tank design does not allow for multi-level sampling d. Revise Diesel Fuel Monitoring Program procedures to include periodic cleaning and internal visual inspection of tanks within the scope of the program. In the areas of any degradation identified during the internal inspection, a volumetric inspection shall be performed. In the event an internal inspection cannot be performed due to design limitations, a volumetric examination shall be performed. Perform cleaning and internal inspections at least once during the 10-year period prior to the period of extended operation and at succeeding 10-year intervals	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)

7	External Surfaces Monitoring	Enhance the External Surfaces Monitoring Program as follows: a. Revise External Surfaces Monitoring Program procedures to include instructions to perform a 100 percent visual inspection of accessible flexible polymeric component surfaces. The visual inspection should identify indicators of loss of material due to wear to include dimensional change, surface cracking, crazing, scuffing, and for flexible polymeric materials with internal reinforcement, the exposure of reinforcing fibers, mesh, or underlying metal. In addition, 10 percent of the available flexible polymeric surface area should receive physical manipulation to augment the visual inspection to confirm the absence of hardening and loss of strength (e.g., HVAC flexible connectors) b. Revise External Surfaces Monitoring Program procedures to conduct representative inspections during each 10-year period on insulated surfaces of each material type (e.g., steel, stainless steel, copper alloy, aluminum) in an air–outdoor or condensation environment c. Revise External Surfaces Monitoring Program procedures as follows 1. Remove insulation in order to perform a visual inspection of a representative sample of insulated indoor components surfaces in a condensation environment and outdoor component surfaces. The inspections shall include a minimum of 20 percent of the in-scope piping length for each material type (e.g., steel, stainless steel, copper alloy, aluminum), or for components with a configuration which does not conform to a 1-foot axial length determination (e.g., valve, accumulator), 20 percent of the surface area. Alternatively, insulation can be removed and a minimum of 25 inspections performed that can be a combination of 1-foot axial length sections and individual components for each material type 2. Include inspection locations based on the likelihood of corrosion under insulation (i.e., components experiencing alternate wetting and drying in environments where trace contaminants could be present and for components that operate for long periods of time below the dew point) 3. Allow subsequent inspections to consist of an examination of the exterior surface of the insulation for indications of damage to the jacketing or protective outer layer of the insulation, if the following conditions are verified in the	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1 -2016-0069 November 10, 2016 (ML16315A235)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
7 (Cont'd)	External Surfaces Monitoring (Cont'd)	initial inspection: no loss of material due to general, pitting or crevice corrosion, beyond that which could have been present during initial construction, and no evidence of cracking 4. Ensure that if the external visual inspections of the insulation reveal damage to the exterior surface of the insulation or there is evidence of water intrusion through the insulation (e.g., water seepage through insulation seams or joints), periodic inspections under the insulation will continue at such intervals that would ensure the component's intended function d. Revise External Surfaces Monitoring Program procedures to provide guidance that removal of tightly adhering insulation that is impermeable to moisture is not required unless there is evidence of damage to the moisture barrier. However, the entire population of in-scope piping component surfaces that have tightly adhering insulation will be visually inspected for damage to the moisture barrier with the same frequency as for other types of insulation inspections. These inspections will not be credited towards the inspection quantities for other types of insulation e. Revise External Surfaces Monitoring Program procedures to include the following acceptance criteria • Stainless steel should have a clean shiny surface with no discoloration • Other metals should not have any abnormal surface indications • Flexible polymeric materials should have a uniform surface texture and color with no cracks and no dimensional change, no abnormal surface with the material in an as new condition with respect to hardness, flexibility, physical dimensions, and color • Rigid polymeric materials should have no erosion, cracking, checking, or chalking		
8	Fatigue Monitoring	Enhance the Fatigue Monitoring Program as follows: a. Revise Fatigue Monitoring Program procedures to monitor and track additional critical thermal and pressure transients for components that have been identified to have a fatigue TLAA b. Develop a set of fatigue usage calculations that consider the effects of the reactor water environment for a set of sample	Enhancement to develop a set of fatigue usage calculations: prior to December 18, 2022. Remaining two enhancements: prior to June 18, 2024.	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
8 (Cont'd)	Fatigue Monitoring (Cont'd)	reactor coolant system components. This sample shall include the location identified in NUREG/CR-6260 and additional plant-specific component locations in the reactor coolant pressure boundary if they are found to be more limiting than those considered in NUREG/CR-6260. F_{en} factors shall be determined using the formulae listed in LRA Section 4.3.3 The methodology for determining limiting locations will be based on EPRI report 1024995 "Environmentally Assisted Fatigue Screening, Process and Technical Basis for Identifying EAF Limiting Locations" with the following modifications. • Components in one thermal zone will not be used to bound components in different thermal zones. • Comparisons between components will use a fatigue correction factor (F_{en}) calculated with realistic dissolved oxygen values, worst case (minimum) metal strain rate, worst case (maximum) sulfur in the metal and maximum metal service temperature. • A U_{en} for one material will not be used to bound the U_{en} for a location of a different material. c. Analysts will ensure that comparisons to determine limiting locations will compare usage values that are determined with comparable methods. For example, a component with a low fatigue usage value determined with a refined analysis may be more limiting than a component with a higher CUF determined with a simplified analysis. d. An environmentally assisted fatigue analysis using NUREG/CR-6909 will not use average temperature for complex transients. For simple transients that use average temperature, when the minimum temperature is below the threshold temperature, the maximum and threshold temperature will be used to calculate the average temperature. e. Revise Fatigue Monitoring Program procedures to provide updates of the fatigue usage calculations on an as-needed basis if an allowable cycle limit is approached or in a case where a transient definition has been changed, unanticipated new thermal events are discovered, or the geometry of components has been modified		W3F1-2016-0070 December 12, 2016 (ML16347A672) W3F1-2017-0039 May 12, 2017 (ML17137A017)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
9	Fire Protection	Enhance the Fire Protection Program as follows: a. Revise Fire Protection Program procedures to include an inspection at least once per refueling cycle of fire barrier walls, ceilings, and floors for any signs of degradation, such as spalling, loss of material caused by chemical attack, or reaction with aggregates b. Revise Fire Protection Program procedures to inspect fire-rated doors for any degradation of door surfaces at least once per refueling cycle. c. Revise Fire Protection Program procedures to ensure fire barrier seals are inspected by personnel qualified in accordance with appropriate NFPA standards d. Revise Fire Protection Program procedures to provide acceptance criteria of no significant indications of concrete spalling, and loss of material of fire barrier walls, ceilings, and floors and in other fire barrier materials e. Revise Fire Protection Program procedures to provide acceptance criteria that specify no surface degradation of fire doors	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
10	Fire Water System	Enhance the Fire Water System Program as follows: a. Revise Fire Water System Program Procedures to inspect for loss of fluid in the glass bulb heat responsive elements b. Revise Fire Water System Program procedures to perform an inspection of each building's wet pipe fire water system every 5 years by opening a flushing connection at the end of one main and by removing a sprinkler toward the end of one branch line for the purpose of inspecting the interior for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head. The inspection method used shall be capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling. Ensure procedures require a follow-up volumetric wall thickness evaluation where irregularities are detected c. Revise Fire Water System Program procedures to perform an internal inspection every five years for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1 -2016-0069 November 10, 2016 (ML16315A235) W3F1-2017-0002 January 16, 2017 (ML17016A027)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
10 (Cont'd)	Fire Water System (Cont'd)	sprinkler head of the dry piping downstream of preaction valves. The inspection shall be performed by opening a flushing connection, removing the most remote sprinkler head, and using a method capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling d. Revise Fire Water System Program procedures to perform an internal inspection every five years for evidence of loss of material and the presence of foreign organic or inorganic material that could result in flow obstructions or blockage of a sprinkler head of the dry piping downstream of the automatic deluge valves. The inspection shall be performed by opening a flushing connection, removing the most remote sprinkler head, and using a method capable of detecting surface irregularities that could indicate wall loss below nominal pipe wall thickness due to corrosion, corrosion product deposition, and flow blockage due to fouling e. Revise Fire Water System Program procedures to perform an inspection of the nozzles associated with the charcoal filters for loss of material and foreign or organic material when the charcoal is replaced f. Revise Fire Water System Program procedures to inspect the interior of the fire water tanks in accordance with NFPA 25 (2011 Edition), Sections 9.2.6 and 9.2.7, including sub-steps g. Revise Fire Water System Program procedures to remove strainers every 5 years and after each actuation to clean and inspect for damage and corroded parts h. Revise Fire Water System Program procedures to specify that sprinkler heads are tested or replaced in accordance with NFPA-25 (2011 Edition), Section 5.3.1 i. Revise Fire Water System Program procedures to conduct a flow test or flush sufficient to detect potential flow blockage, or conduct 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 in each 5-year interval, beginning 5 years prior to the period of extended operation j. Revise Fire Water System Program procedures to perform volumetric wall thickness inspections of 20 percent of the length of piping segments that cannot be drained or piping segments that allow water to collect each 5-year interval of the		

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
10 (Cont'd)	Fire Water System (Cont'd)	period of extended operation. Measurement points shall be obtained to the extent that each potential degraded condition can be identified (e.g., general corrosion, MIC). The 20 percent of piping that is inspected in each 5-year interval is in different locations than previously inspected piping k. Revise the Fire Water System Program procedures to perform a blockage evaluation if the flowing pressure decreases by more than 10 percent from the original main drain test or previous main drain tests l. Revise the Fire Water System Program procedures to flow test the charcoal filter unit's manual deluge valve systems with air on an annual basis to ensure there are no obstructions. If obstructions are found, the system shall be cleaned and retested m. Revise the Fire Water System Program procedures to trip test with flow at least once every 18 months the deluge valve systems for the main turbine lube oil tank and main feedwater pumps. If obstructions are found, the system shall be cleaned and retested n. Revise the Fire Water System Program procedures to open and close hydrant valves slowly while performing flow tests to prevent surges in the system. The program shall also require full opening of the hydrant valve o. Revise the Fire Water System Program procedures to verify the hydrants drain within 60 minutes after flushing or flow testing p. Revise Fire Water System Program procedures to perform vacuum box testing on the bottom of the tank to identify leaks. In the event the bottom of the fire water tank is uneven, the station will perform a suitable NDE technique rather than vacuum box testing to identify leaks q. Revise the Fire Water System Program procedures to ensure the training and qualification of the individual performing the evaluation of fire water storage tank coating degradation is in accordance with ASTM International standards endorsed in RG 1.54, including limitations, if any, identified in RG 1.54 on a particular standard r. Revise Fire Water System Program procedures to perform wet sponge and dry film testing on the coating applied to the interior of the fire water tanks		

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
10 (Cont'd)	Fire Water System (Cont'd)	s. Revise the Fire Water System Program procedures to ensure a fire water tank is not returned to service after identifying interior coating blistering, delamination or peeling unless there are only a few small intact blisters surrounded by coating bonded to the substrate as determined by a qualified coating specialist, or the following actions are performed: • Any blistering in excess of a few small intact blisters that are not growing in size or number, or blistering not completely surrounded by coating bonded to the substrate is removed • Any delaminated or peeled coating is removed • The exposed underlying coating is verified to be securely bonded to the substrate as determined by an adhesion test endorsed by RG 1.54 at a minimum of three locations • The outermost coating is feathered and the remaining outermost coating is determined to be securely bonded to the coating below via an adhesion test endorsed by RG 1.54 at a minimum of three locations adjacent to the defective area • Ultrasonic testing is performed where there is evidence of pitting or corrosion to ensure the tank meets minimum wall thickness requirements • An evaluation is performed to ensure downstream flow blockage is not a concern • A follow-up inspection is scheduled to be performed within two years and every two years after that until the coating is repaired, replaced, or removed t. Revise Fire Water System Program procedures to determine the extent of coating defects on the interior of the fire water tanks by using one or more of the following methods when conditions such as cracking, peeling, blistering, delamination, rust, or flaking are identified during visual examination. • Lightly tapping and scraping the coating to determine the coating integrity • Dry film thickness measurements at random locations to determine overall thickness of the coating • Wet-sponge testing or dry film testing to identify holidays in the coating		

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<tr><th>Item No.</th><th>Program or Activity</th><th>Commitment</th><th>Implementation Schedule</th><th>Source</th></tr>
<tr><td>10
(Cont’d)</td><td>Fire Water System
(Cont’d)</td><td>• Adhesion testing in accordance with ASTM D3359, ASTM D4541, or equivalent testing endorsed by RG 1.54 at a minimum of three locations
• Ultrasonic testing where there is evidence of pitting or corrosion to determine if the tank thickness meets the minimum thickness criteria
u. Revise Fire Water System Program procedures to include acceptance criteria for the fire water tanks' interior coating that include:
• Indications of peeling and delamination are not acceptable
• Blisters are evaluated by a coatings specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54 including limitations, if any, identified in RG 1.54 on a particular standard. Blisters should be limited to a few intact small blisters that are completely surrounded by sound coating/lining bonded to the substrate. Blister size and frequency should not be increasing between inspections (e.g., reference ASTM D714-02, "Standard Test Method for Evaluating Degree of Blistering of Paints")
• Indications such as cracking, flaking, and rusting are to be evaluated by a coatings specialist qualified in accordance with an ASTM International standard endorsed in RG 1.54 including limitations, if any, identified in RG 1.54 on a particular standard
• As applicable, wall thickness measurements, projected to the next inspection, meet design minimum wall requirements
• When conducting adhesion testing, results meet or exceed the degree of adhesion recommended in plant-specific design requirements specific to the coating/lining and substrate
v. Revise Fire Water System Program procedures to include acceptance criteria of no abnormal debris (i.e., no corrosion products that could impede flow or cause downstream components to become clogged). Any signs of abnormal corrosion or blockage will be removed, its source and extent of</td><td></td><td></td></tr>
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Item No.	Program or Activity	Commitment	Implementation Schedule	Source
10 (Cont'd)	Fire Water System (Cont'd)	condition determined and corrected, and entered into the corrective action program w. Revise Fire Water System Program procedures to specify replacement of any sprinkler heads that show signs of leakage, excessive loading, corrosion, or loss of fluid in the glass bulb heat responsive element x. Revise Fire Water System Program procedures to perform an obstruction evaluation if any of the following conditions exist: • There is an obstructive discharge of material during routine flow tests • An inspector's test valve is clogged during routine testing • Foreign materials are identified during internal inspections • Sprinkler heads are found clogged during removal or testing • Pin hole leaks are identified in fire water piping • After an extended fire water system shutdown (greater than one year) • There is a 50% increase in time it takes for water to flow out the inspector test valve after the associated dry valve is tripped when compared to the original acceptance criteria or last test y. Revise Fire Water System Program procedures to evaluate for MIC if tubercules or slime are identified during any internal inspections of fire water piping z. Revise the Fire Water System Program procedures to perform preaction valve trip testing every three years with the manual isolation valve closed		
11	Flow-Accelerated Corrosion	Enhance the Flow-Accelerated Corrosion Program as follows: a. Revise Flow-Accelerated Corrosion Program procedures to (1) manage wall thinning due to erosion mechanisms from cavitation, flashing, liquid droplet impingement, and solid particle impingement; (2) include susceptible locations based on the extent-of-condition reviews in response to plant-specific or industry operating experience, and EPRI TR-1011231, *Recommendations for Controlling Cavitation, Flashing, Liquid Droplet Impingement, and Solid Particle Erosion in Nuclear*	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
11 (Cont'd)	Flow-Accelerated Corrosion (Cont'd)	*Power Plant Piping*, and NUREG/CR-6031, *Cavitation Guide for Control Valves*; (3) ensure piping and components replaced with FAC-resistant material and subject to erosive conditions are not excluded from inspections; and (4) include the need for continued wall thickness measurements of replaced piping until the effectiveness of the corrective action is assured b. Revise Flow-Accelerated Corrosion Program procedures to evaluate wall thinning due to erosion from cavitation, flashing, liquid droplet impingement, and solid particle impingement when determining a replacement type of material.		
12	Inservice Inspection – IWF	Enhance the ISI-IWF Program as follows: a. Revise plant procedures to include the preventive actions for storage of ASTM A325, ASTM F1852, and ASTM A490 bolting from Section 2 of Research Council on Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts" b. Revise plant procedures to specify that detection of aging effects will include monitoring anchor bolts for loss of material, loose or missing nuts and bolts, and cracking of concrete around the anchor bolts c. Revise plant procedures to specify the following conditions as unacceptable: • Loss of material due to corrosion or wear, which reduces the load bearing capacity of the component support • Debris, dirt, or excessive wear that could prevent or restrict sliding of the sliding surfaces as intended in the design basis of the support • Cracked or sheared bolts, including high strength bolts, and anchors d. Revise plant procedures to include assessment of the impact on the inspection sample representativeness if components that are part of the sample population are reworked	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2016-0070 December 12, 2016 (ML16347A672)
12.a	Inservice Inspection	Revise Inservice Inspection Program procedures to include a supplemental inspection of Class 1 CASS piping components that do not meet the material selection criteria of NUREG-0313, Revision 2, with regard to ferrite and carbon content. An inspection technique qualified by ASME or EPRI will be used to monitor cracking	Prior to June 18, 2024	W3F1-2016-0074 December 7, 2016 (ML16342C485)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
13	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program as follows: a. Revise plant procedures to specify monitoring of crane rails for loss of material due to wear; monitoring structural components of the bridge, trolley and hoists for deformation, cracking, and loss of material due to corrosion; and monitoring structural connections for loose or missing bolts, nuts, pins or rivets and any other conditions indicative of loss of bolting integrity b. Revise plant procedures to specify inspection frequency in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series. Infrequently used cranes and hoists will be inspected prior to use. Bolted connections will be visually inspected for loose or missing bolts, nuts, pins or rivets at the same frequency as crane rails and structural components c. Revise plant procedures to require that significant loss of material due to wear of crane rails and any sign of loss of bolting integrity will be evaluated in accordance with ASME B30.2 or other appropriate standard in the ASME B30 series d. Revise plant procedures to specify that maintenance and repair activities will utilize the guidance provided in ASME B30.2 or other appropriate standard in the ASME B30 series	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
14	Internal Surfaces in Miscellaneous Piping and Ducting Components	Implement the Internal Surfaces in Miscellaneous Piping and Ducting Components Program as described in LRA Section B.1.18.	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
15	Masonry Wall	Enhance the Masonry Wall Program as follows: a. Revise plant procedures to ensure masonry walls located within in-scope structures are included in the scope of the Masonry Wall Program b. Revise plant procedures to include monitoring gaps between the structural steel supports and masonry walls that could potentially affect wall qualification c. Revise plant procedures to specify that masonry walls will be inspected at least once every 5 years with provisions for more frequent inspections in areas where significant aging effects (missing blocks, cracking, etc.) are observed to ensure there is no loss of intended function d. Revise plant procedures to include acceptance criteria for masonry wall inspections that ensure observed aging effects (cracking, loss of material, or gaps between the structural steel supports and masonry walls) do not invalidate the wall's evaluation basis or impact its intended function	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
16	Metal Enclosed Bus Inspection	Implement the Metal Enclosed Bus Inspection Program as described in LRA Section B.1.20.	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
17	Neutron-Absorbing Material Monitoring	Enhance the Neutron-Absorbing Material Monitoring Program as follows: a. Revise Neutron-Absorbing Material Monitoring Program procedures to compare measurements from periodic inspections to prior measurements, and relate coupon measurement results to the performance of the spent fuel neutron-absorber materials considering differences in exposure conditions, vented/non-vented test samples, spent fuel racks, etc. Ensure the predicted boron-10 areal density will be sufficient to maintain the subcritical conditions required by technical specifications until the next coupon test.	Prior to June 18, 2024 The inspection will be performed prior to the period of extended operation and at least once every 10 years during the period of extended operation	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2017-0002 January 16, 2017 (ML17016A027)
18	Non-EQ Electrical Cable Connections	Implement the Non-EQ Electrical Cable Connections Program as described in LRA Section B.1.23.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
19	Non-EQ Inaccessible Power Cables (≥ 400 V)	Implement the Non-EQ Inaccessible Power Cables (≥ 400 V) Program as described in LRA Section B.1.24.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
20	Non-EQ Sensitive Instrumentation Circuits Test Review	Implement the Non-EQ Sensitive Instrumentation Circuits Test Review Program as described in LRA Section B.1.25.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
21	Non-EQ Insulated Cables and Connections	Implement the Non-EQ Insulated Cables and Connections Program as described in LRA Section B.1.26.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
22	One-Time Inspection	Implement the One-Time Inspection Program as described in LRA Section B.1.28.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1 -2016-0069 November 10, 2016 (ML16315A235) W3F1-2016-0071 January 9, 2017 (ML17009A409) W3F1 -2017-0005 February 1, 2017 (ML17032A516) W3F1-2017-0015 March 16, 2017 (ML17075A412)
23	One-Time Inspection – Small-Bore Piping	Implement the One-Time Inspection – Small-Bore Piping Program as described in LRA Section B.1.29.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2016-0070 December 12, 2016 (ML16347A672)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
24	Periodic Surveillance and Preventive Maintenance	Enhance the Periodic Surveillance and Preventive Maintenance Program as described in LRA Section B.1.30.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 W3F1 -2016-0069 November 10, 2016 (ML16315A235) W3F1-2016-0070 December 12, 2016 (ML16347A672) W3F1-2016-0071 January 9, 2017 (ML17009A409) W3F1 -2017-0005 February 1, 2017 (ML17032A516) W3F1 -2017-0006 February 23, 2017 (ML17054D239) W3F1-2017-0015 March 16, 2017 (ML17075A412)
25	Protective Coating Monitoring and Maintenance	Enhance the Protective Coating Monitoring and Maintenance Program as follows: a. Revise plant procedures to specify visual inspections of coatings near sumps or screens associated with the emergency core cooling system	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
26	Reactor Head Closure Studs	Enhance the Reactor Head Closure Studs Program as follows: a. Revise Reactor Head Closure Studs Program procedures to ensure that replacement studs are fabricated from bolting material with actual measured yield strength less than 150 kilo-pounds per square inch b. Revise Reactor Head Closure Studs Program procedures to exclude the use of molybdenum disulfide (MoS_2) on the reactor vessel closure studs and refer to RG 1.65, Rev. 1	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
27	Reactor Vessel Internals	Enhance the Reactor Vessel Internals Program as follows: a. Revise Reactor Vessel Internals Program procedures to include the inspections identified in the inspection plan in NRC submittal W3F1-2013-0070, dated December 16, 2013, including the inspection of the core stabilizing bolts as an addition to the WF3 ASME Section XI In-Service Inspection Program	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
28	Selective Leaching	Implement the Selective Leaching Program as described in LRA Section B.1.35.	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324)
29	Service Water Integrity	Enhance the Service Water Integrity Program as follows: a. Revise Service Water Integrity Program procedures to (1) flush redundant, infrequently flowed sections, and stagnant lines to ensure there is no blockage, and (2) inspect selected low flow or stagnant areas and system low points such as drains	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1 -2016-0069 November 10, 2016 (ML16315A235) W3F1-2016-0070 December 12, 2016 (ML16347A672) W3F1-2017-0015 March 16, 2017 (ML17075A412)

30	Structures Monitoring	Enhance the Structures Monitoring Program as follows: a. Revise plant procedures to include the following in-scope structures: • Battery house 230kV switchyard • Control house 230kV switchyard • Fire pump house • Fire water storage tank foundations • Fuel oil storage tank foundation • Manholes, handholes and duct banks • Plant stack • Transformer and switchyard support structures and foundations Revise plant procedures to include a list of structural components and commodities within the scope of the program Revise plant procedures to include periodic sampling and chemical analysis of ground water b. Revise plant procedures to include the preventive actions for storage of ASTM A325, ASTM F1852, and ASTM A490 bolting from Section 2 of Research Council on Structural Connections publication, "Specification for Structural Joints Using ASTM A325 or A490 Bolts" c. Revise plant procedures to include the following parameters to be monitored or inspected: • For concrete structures, base inspections on quantitative requirements of industry codes, standards and guidelines (e.g., ASCE 11, ACI 349.3R) and consideration of industry and plant-specific operating experience • For concrete structures and components include loss of material, loss of bond, increase in porosity and permeability, loss of strength, and reduction in concrete anchor capacity due to local concrete degradation • For chemical analysis of ground water, monitor pH, chlorides and sulfates	Prior to June 18, 2024, or the end of the last refueling outage prior to December 18, 2024, whichever is later.	W3F1-2016-0012 March 23, 2016 (ML16088A324) W3F1-2017-0026 April 11, 2017 (ML17102A856)

30 (Cont'd)	Structures Monitoring (Cont'd)	Revise plant procedures to include the following components to be monitored for the associated parameters: • Anchor bolts (nuts and bolts) for loss of material and loose or missing nuts and bolts • Elastomeric vibration isolators and structural sealants for cracking, loss of material, loss of sealing, and change in material properties (e.g., hardening) d. Revise plant procedures to include the following: • Visual inspection of elastomeric material should be supplemented by feel or touch to detect hardening if the intended function of the elastomeric material is suspect. Include instructions to augment the visual examination of elastomeric material with physical manipulation of at least 10 percent of available surface area • Structures will be inspected at least once every 5 years with provisions for more frequent inspections of structures and components categorized as (a)(1) in accordance with 10 CFR 50.65 • Submerged structures will be inspected at least once every 5 years • Sampling and chemical analysis of ground water at least once every 5 years. The program owner will review the results and evaluate any anomalies and perform trending of the results e. Revise plant procedures to inspect the SIT and RCS supports with ASTM A-540 high-strength bolting greater than one-inch nominal diameter prior to the period of extended operation and at least once every 5 years thereafter. The periodic visual inspections are intended to detect whether a corrosive environment that supports SCC potential exists or has existed since the previous inspection. Acceptance criteria for the inspections will be the absence of evidence of moisture, residue, foreign substances, or corrosion Conditions that don't meet the acceptance criteria and thus indicate a potential corrosive environment that supports SCC will be entered into the corrective action program for evaluation f. Revise plant procedures to include qualitative and quantitative acceptance criteria for A-540 bolts as follows:		

30 (Cont'd)	Structures Monitoring (Cont'd)	1) If moisture is present at or near a bolt or stud, factors considered by engineering include, but will not be limited to: • The source of leakage or condensation that supplied the moisture. • The proximity of the moisture to the bolt or stud. • The probable or analyzed chemical characteristics of the moisture, including the presence of contaminants. • The visible or likely pathway, if any, that the liquid traversed to arrive at or near the bolt or stud. • The amount of any corrosion on or near the bolt or stud. • The material condition of the coatings on the bolt or stud, and associated support. • The characteristics of any corrosion on or near the bolt or stud. • The proximity to the bolt or stud of any nearby evidence of corrosion. • The material condition of accessible concrete or grout near the bolt or stud. 2) If there is evidence that moisture had been present at or near a bolt or stud, but no moisture is present at or near a bolt or stud, factors considered by engineering include, but will not be limited to: • The probable sources of past leakage or condensation that could have supplied the moisture. • The proximity to the bolt or stud to the evidence that moisture had been present. • The probable or analyzed chemical characteristics of any moisture residue, including the presence of contaminants. • The visible or likely pathway, if any, that the liquid may have traversed to arrive at or near the bolt or stud. • The amount of any corrosion on or near the bolt or stud. • The material condition of any coatings on the bolt or stud, and associated support. • The characteristics of any corrosion on or near the bolt or stud. • The proximity to the bolt or stud of any nearby evidence of corrosion.		

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
30 (Cont'd)	Structures Monitoring (Cont'd)	• The material condition of concrete or grout near the bolt or stud. • Should adverse conditions be identified during the examinations, engineering will determine if the bolting has been exposed to a corrosive environment with the potential to cause SCC. Bolts determined to have been exposed to a corrosive environment with the potential to cause SCC will be identified as within a population where SCC is a concern. A sample equal to 20 percent (rounded up to the nearest whole number) of the population, with a maximum sample size of 25 bolts will be subject to volumetric examination. The selection of the samples will consider susceptibility to stress corrosion cracking (e.g., actual measured yield strength) and ALARA considerations.		
31	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel	Implement the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program as described in LRA Section B.1.39.	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)
32	Water Chemistry Control – Closed Treated Water Systems	Enhance the Water Chemistry Control – Closed Treated Water Systems Program as follows: a. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to include high pressure fire water diesel pump jacket water system b. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters that are in accordance with EPRI 1007820, industry guidance, or vendor recommendations c. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to inspect accessible components whenever a closed treated water system boundary is opened. Ensure that a representative sample of piping and components is inspected at a frequency of at least every 10 years. These inspections will be conducted in accordance with applicable ASME Code requirements, industry standards, or other plant-specific inspection guidance by qualified personnel using procedures that are capable of detecting corrosion, fouling, or cracking. If visual examination	Prior to June 18, 2024	W3F1-2016-0012 March 23, 2016 (ML16088A324)

Item No.	Program or Activity	Commitment	Implementation Schedule	Source
32 (Cont'd)	Water Chemistry Control – Closed Treated Water Systems (Cont'd)	identifies adverse conditions, additional examinations, including ultrasonic testing, are conducted d. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to define a representative sample as 20 percent of the population (defined as components having the same material, environment, and aging effect combination) with a maximum of 25 components. Components inspected will be those with the highest likelihood of corrosion, fouling, or cracking e. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to perform treated water sampling and analysis of the closed treated water systems per industry standards and in no case greater than quarterly unless justified with an additional analysis f. Revise Water Chemistry Control – Closed Treated Water Systems Program procedures to specify water chemistry parameters monitored and the acceptable range of values for these parameters that are in accordance with EPRI 1007820, industry guidance, or vendor recommendations g. Revise the Water Chemistry Control – Closed Treated Water Systems Program procedures to provide acceptance criteria for inspections. Ensure system components meet system design requirements, such as minimum wall thickness		
33	Steam Generator Integrity	Enhance the Steam Generator Integrity Program as follows: a. Revise the Steam Generator Integrity Program to include general visual inspection of the partition plate, channel head, and tubesheet (primary side) with a frequency of at least once every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections	Prior to June 18, 2024	W3F1-2016-0075 December 7, 2016 (ML16342C491) W3F1-2017-0015 March 16, 2017 (ML17075A412)
34	Reactor Vessel Surveillance	Enhance the Reactor Vessel Surveillance Program as follows: a. Revise Reactor Vessel Surveillance Program procedures to specify submittal of a withdrawal schedule for Capsule 277° to the NRC for review and approval within one (1) year following the receipt of the renewed license	Within one (1) year following issuance of the renewed license	W3F1-2017- 0023 March 30, 2017 ML17089A358

APPENDIX B

CHRONOLOGY

B. Chronology

This appendix contains a chronological listing of the routine correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff) and Entergy Operations, Inc. (Entergy or the applicant), and other correspondence regarding the staff's safety review of the Waterford Steam Electric Station Unit 3 (WF3) license renewal application (LRA), Docket No. 50-382.

Document Date	Title
03/23/2016	Letter from Chisum, M., Entergy. "License Renewal Application, Waterford Steam Electric Station, Unit 3." (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML16088A324)
04/16/2016	Letter from Miller, C., to Chisum, M. "Receipt and Availability of the License Renewal Application for the Waterford Steam Electric Station, Unit 3." (ADAMS Package Accession No. ML16055A222)
04/08/2016	NRC Press Release-16-018. "NRC Announces Public Availability of Waterford Nuclear Plant License Renewal Application." (ADAMS Accession No. ML16099A264)
05/18/2016	Letter from Diaz-Sanabria, Y., NRC, to Chisum, M., Entergy. "Waterford Steam Electric Station, Unit 3, License Renewal Application Online Reference Portal." (ADAMS Accession No. ML16118A408)
05/20/2016	Letter from Marshall, J.E., NRC, to Kowalewski, J.A., Entergy. "Waterford Station, Unit 3, Acceptance-Letter Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for A Hearing Regarding the Application from Entergy Operations, Inc., for Renewal of the Operating License for the Waterford Steam Electric Station, Unit 3." (ADAMS Accession No. ML16130A023)
05/31/2016	NRC Press Release-16-032. "NRC Announces Hearing Opportunity for Waterford License Renewal; Public Meeting June 8 to Discuss Environmental Review." (ADAMS Accession No. ML16152A611)
06/06/2016	Letter from Clark, P., NRC, to Chisum, M., Entergy. "Plan for the Scoping and Screening Regulatory Audit Regarding the Waterford Steam Electric Station, Unit 3, License Renewal Application Review." (ADAMS Package Accession No. ML16152A008)
06/28/2016	Letter from Clark, P., NRC, to Chisum, M., Entergy. "Plan for the Aging Management Program Regulatory Audits Regarding the Waterford Steam Electric Station, Unit 3 License Renewal Application Review." (ADAMS Accession No. ML16168A359)
09/15/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Request for Additional Information for the Review of Waterford Steam Electric Station Unit 3 License Renewal Application – Set 1." (ADAMS Accession No. ML16272A375)
10/12/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application, Set 2 (TAC No. MF7492)." (ADAMS Accession No. ML16285A338)
10/12/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 3 (TAC No. MF7492)." (ADAMS Accession No. ML16285A339)
10/12/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Request for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 4 (TAC No. MF7492)." (ADAMS Accession No. ML16285A340)
10/13/2016	Letter from Chisum, M., Entergy. "Responses to Request for Additional Information Set 1 Regarding the License Renewal Application for Waterford Steam Electric Station, Unit 3." (ADAMS Accession No. ML16287A675)
11/07/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application; Set 5 (CAC No. MF7492)." (ADAMS Accession No. ML16307A006)

Document Date	Title
11/07/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application Set 6 (CAC No. MF7492)." (ADAMS Accession No. ML16307A007)
11/10/2016	Letter from Clark, P., NRC, to Chisum, M., Entergy. "Scoping And Screening Methodology Audit Report Regarding Waterford Steam Electric Station, Unit 3 License Renewal Application Review (CAC No. MF7492)." (ADAMS Accession No. ML16299A282)
11/10/2016	Letter from Chisum, M., Entergy. "Waterford Steam Electric Station, Unit 3, Responses to Request for Additional Information Set 2 Regarding the License Renewal Application." (ADAMS Accession No. ML16315A235)
11/15/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 7 (CAC No. MF7492)." (ADAMS Accession No. ML16320A002)
11/15/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application Set 8 (CAC No. MF7492)." (ADAMS Accession No. ML16320A003)
11/23/2016	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information for Environmental Review Regarding the License Renewal Application." (ADAMS Accession No. ML16328A414)
12/02/2016	Email from Clark, P., NRC, to Chisum, M., "Waterford Steam Electric Station, Unit 3, License Renewal Application – RAI Set 9 (CAC No. MF7492)" (ADAMS Accession No. ML16335A374)
12/07/2016	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 5 Regarding the License Renewal Application." (ADAMS Accession No. ML16342C485)
12/07/2016	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 6 Regarding the License Renewal Application." (ADAMS Accession No. ML16342C491)
12/08/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 10." (ADAMS Accession No. ML16343A072)
12/12/2016	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 3 Regarding the License Renewal Application." (ADAMS Accession No. ML16347A672)
12/15/2016	Letter from Chisum, M., Entergy. "Waterford, Unit 3 – Responses to Request for Additional Information Set 7 Regarding the License Renewal Application." (ADAMS Accession No. ML16350A450)
12/19/2016	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests For Additional Information For The Review Of The Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 11 (CAC No. MF7492)." (ADAMS Accession No. ML16351A045)
12/21/2016	Letter from Clark, P., NRC. "November 30, 2016 Summary of Teleconference Held between NRC and Entergy Operations, Inc. Concerning RAI Set 9 Pertaining to the Waterford Steam Electric Station, Unit 3, License Renewal Application (CAC No. MF7492)." (ADAMS Accession No. ML16341B063)
12/30/2016	Letter from Clark, P., NRC. "12/07/2016 Summary of Teleconference with Entergy Operations, Inc. Concerning Requests for Additional Information Set 10 Pertaining to the Waterford Steam Electric Station Unit 3 License Renewal Application." (ADAMS Accession No. ML16356A582)
01/09/2017	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 4 Regarding the License Renewal Application." (ADAMS Accession No. ML17009A409)
01/16/2017	Letter from Chisum, M., Entergy. "Waterford Steam Electric Station, Unit 3, Responses to Request for Additional Information Sets 8 and 9 Regarding the License Renewal Application." (ADAMS Accession No. ML17016A027)

Document Date	Title
01/19/2017	Letter from Chisum, M., Entergy. "Waterford Steam Electric Station, Unit 3, Responses to Request for Additional Information Set 10 Regarding the License Renewal Application." (ADAMS Accession No. ML17019A156)
01/24/2017	Letter from Clark, P., NRC. "08/23-25/2016 Summary of Teleconference Meetings with Entergy Operations Inc., Concerning RAI Set 1 Pertaining to the Waterford Steam Electric Station, Unit 3 License Renewal Application." (ADAMS Accession No. ML16323A229)
01/26/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application Set 12 (CAC MF7492.)" (ADAMS Accession No. ML17018A359)
02/01/2017	Letter from Chisum, M., Entergy. "Waterford Steam Electric Station, Unit 3, Responses to Request for Additional Information Set 11 Regarding the License Renewal Application." (ADAMS Accession No. ML17032A516)
02/06/2017	Letter from Chisum, M., Entergy. "Waterford, Unit 3 – Responses to Request for Additional Information from Sets 4, 5, and 6 Regarding the License Renewal Application." (ADAMS Accession No. ML17037D400)
02/14/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 13 (CAC No. MF7492)." (ADAMS Accession No. ML17040A538)
02/23/2017	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 12 Regarding the License Renewal Application." (ADAMS Accession No. ML17054D239)
03/01/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Request for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application - Set 14 (CAC No. MF7492)" (ADAMS Accession No. ML17272A335)
03/14/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application Set 15 (CAC No. MF7492)" (ADAMS Accession No. ML17072A010)
03/16/2017	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 13 Regarding the License Renewal Application." (ADAMS Accession No. ML17075A412)
03/30/2017	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 14 Regarding the License Renewal Application." (ADAMS Accession No. ML17089A358)
03/30/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Summary of Telecon Held on March 28, 2017, between NRC and Entergy Concerning RAI Pertaining to the Waterford Steam Electric Station License Renewal Application (CAC No. MF7493)." (ADAMS Accession No. ML17088A185)
03/31/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Summary of Telecon Held on March 28, 2017, between the NRC and Entergy Concerning RAI Pertaining to the Waterford Steam Electric Station License Renewal Application (CAC No. MF7493) – UPDATED WITH ADAMS ACCESSION NOS." (ADAMS Accession No. ML17090A047)
03/31/2017	Letter from Werner, G., NRC, to Chisum, M., Entergy. "Waterford, Unit 3 – NRC License Renewal Inspection Report 05000382/2017007. (ADAMS Accession No. ML17094A238)
04/03/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 16 (CAC No. MF7492)." (ADAMS Accession No. ML17073A001)
04/11/2017	Letter from Chisum, M., Entergy. "Waterford, Unit 3 – Responses to Request for Additional Information Set 15 Regarding the License Renewal Application." (ADAMS Accession No. ML17102A856)
04/17/2017	Email from Clark, P., NRC, to Chisum, M., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 17 (CAC No. MF7492)." (ADAMS Accession No. ML17101A443)
05/02/2017	Letter from Chisum, M., Entergy. "Waterford, Unit 3 – Responses to Request for Additional Information Set 16 Regarding the License Renewal Application." (ADAMS Accession No. ML17122A176)

Document Date	Title
05/09/2017	Letter from Clark, P., NRC, to Chisum, M., Entergy. "Aging Management Programs Audit Report Regarding Waterford Steam Electric Station, Unit 3 License Renewal Application Review (CAC No. MF7492)." (ADAMS Accession No. ML17054C529)
05/12/2017	Letter from Chisum, M., Entergy. "Waterford 3 – Responses to Request for Additional Information Set 17 Regarding the License Renewal Application." (ADAMS Accession No. ML17137A017)
08/07/2017	Letter from Farnholtz, T., NRC, to Chisum, M., Entergy. "Waterford Steam Electric Station, UNIT 3, – NRC Baseline Inspection Report 05000382/2017010." (ADAMS Accession No. ML17219A723)
08/08/2017	Letter from Miller, G., NRC, to Chisum, M., Entergy. Waterford Steam Electric Station, UNIT 3, – NRC Integrated Inspection Report 05000382/2017002." (ADAMS Accession No. ML17220A356)
08/24/2017	Letter from Sheldon, S., NRC, to Chisum, M., Entergy. "Status Update Schedule Revision for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application (CAC Nos. MF7492 and MF7493)." (ADAMS Accession No. ML17131A194)
11/15/2017	Letter from Dinelli, J., Entergy. "Amendment 1 to License Renewal Application (LAA) Waterford Steam Electric Station, Unit 3, Docket No. 50-382, License No. NPF-38." (ADAMS Accession No. ML17319A421)
11/28/2017	Letter from Dinelli, J., Entergy. "License Amendment Request for use of RAPTOR-M3G Code for Neutron Fluence Calculations, Waterford Steam Electric Station, Unit 3 (Waterford 3), Docket No. 50-382, License No. NPF-38." (ADAMS Accession No. ML17332A898)
12/07/2017	Letter from Dinelli, J., Entergy. "License Renewal Application Supplement Clarification Waterford Steam Electric Station, Unit 3 (Waterford 3), Docket No. 50-382, License No. NPF-38." (ADAMS Accession No. ML17341A295)
12/20/2017	Letter from Wilson, G., NRC, to Chisum, M., Entergy. "Status Update Schedule Revision for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application (CAC Nos. MF7492 and MF7493)." (ADAMS Accession No. ML17347A127)
03/26/2018	Email from Clark, P., NRC, to Dinelli, J., Entergy. "Requests for Additional Information for the Review of the Waterford Steam Electric Station, Unit 3, License Renewal Application – Set 18 (CAC No. MF7492)." (ADAMS Accession No. ML18085A694)
04/23/2018	Letter from Dinelli, J., Entergy. "Responses to Request for Additional Information Set 18 Regarding the License Renewal Application for Waterford Steam Electric Station, Unit 3 (Waterford 3), Docket No. 50-382, License No. NPF-38." (ADAMS Accession No. ML18113A517)
06/26/2018	Letter from Dinelli, J., Entergy. "Supplement to the License Renewal Application for Waterford Steam Electric Station, Unit 3 (Waterford 3), Docket No. 50-382, License No. NPF-38." (ADAMS Accession No. ML18177A166)
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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.

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Alley, David	Management Oversight
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Brittner, Donald	Reviewer – Operating Experience
Buford, Angela	Reviewer – Structural
Cuadrado de Jesús, Samuel	Reviewer – Structural
Donoghue, Joseph	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
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Holston, William	Reviewer – Mechanical and Materials
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APPENDIX D

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This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application for Waterford Steam Electric Station Unit 3 (WF3).

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